Dana® Spicer® Tandem Drive Axles

DANA SPICER® Drivetrain Products

Service Manual

Single Reduction & Single Reduction with Wheel Differential Lock

AXSM0046

November 2013

DS/RS344
DS/RS404(P)
DS/RS405(P)
DS/RS454(P)
DD/RD404
DD/RD405
DD/RD454
DDT41(P)
DA/RA344
DA/RA404(P)
DA/RA405(P)
DSP/RSP40
DSP/RSP41
DSH/RSH40
DSH/RSH44
DDH/RDH40
DDH/RDH44
DST40(P)
DST41(P)

General Information

The description and specifications contained in this service publication are current at the time of printing. Dana reserves the right to discontinue or to modify its models and/or procedures and to change specifications at any time without notice.

Any reference to brand names in this publication is made simply as an example of the types of tools and materials recommended for use and should not be considered an endorsement. Equivalents, if available, may be used.

Important Notice

This symbol is used throughout this manual to call attention to procedures where carelessness or failure to follow specific instructions may result in personal injury and/or component damage.

Departure from the instructions, choice of tools, materials and recommended parts mentioned in this publication may jeopardize the personal safety of the service technician or vehicle operator.

WARNING: Failure to follow indicated procedures creates a high risk of personal injury to the servicing technician.

CAUTION: Failure to follow indicated procedures may cause component damage or malfunction.

IMPORTANT: Highly recommended procedures for proper service of this unit.

NOTE: Additional service information not covered in the service procedures.

TIP: Helpful removal and installation procedures to aid in the service of this unit.

Always use genuine Spicer replacement parts.

Table of Contents

General Information

General Information i
Introduction 1
Model Identification 2
Ring Gear and Pinion 3

Inspection

Failure Analysis 4
Prepare the Parts for Inspection 5
Inspection 6
Check Input Shaft End-play (Forward Axle) 7

Remove Differential Carrier

Differential Carrier Assembly - Parts 8
Remove Differential Carrier (Forward and Rear) 9

Install Differential Carrier

Install Differential Carrier (Forward and Rear) 10

Differential Lockout

Inter-Axle Lockout Types 11
Remove Lockout 14

Power Divider

Power Divider - Parts Exploded View 15
Remove Power Divider 16
Disassemble, Assemble and Overhaul the Power Divider 17
Remove Lube Pump 21
Install Power Divider to Carrier Assembly 22
Disassemble, Assemble and Overhaul Power Divider 24
Remove Lube Pump-Assemblies Built Before June 15 2008 27
Pump Removal: Assemblies Built After June 15, 2008 28
Lube Pump Installation: Assemblies Built Before June 2008 29
Manifold Installation 31
Hose/ Filter Assembly 32
Install Power Divider to Carrier Assembly 33
Disassemble, Assemble and Overhaul Power Divider 36
Lube Pump Removal: Assemblies Built Before June 15, 2008 39

Lube Pump Removal: Assemblies Built After June 2008 40
Lube Pump Installation: Assemblies Built After June 2008 41
Manifold Assembly 43
Hose/ Filter Assembly 44
Install Power Divider to Carrier Assembly 45
Measure and Adjust Input Shaft End-Play 47

Carrier Assembly

Carrier Assembly - Parts Exploded View 49

Drive Pinion

Front Axle Pinion Assembly - Parts Exploded View 53
Disassemble and Overhaul Drive Pinion 54
Replace Pinion Bearing Cage Cups 56
Adjust Pinion Bearing Preload 57
Final Buildup 58
Install Drive Pinion Assembly 61

Wheel Differential Assembly

Wheel Differential - Parts Exploded View 63
Disassemble, Overhaul and Assemble Wheel Differential (Forward and Rear Axles) 64
Overhaul and Assemble Wheel Differential 65
Measure and Adjust Carrier Assembly 67
Change Backlash Setting 68

Adjust Tooth Contact Pattern

Adjust Ring and Pinion Tooth contact Pattern 69
Adjust Pinion Position 70

Wheel Differential Lock

Wheel Differential Lock - Parts Exploded View 71
Install and Adjust Wheel Differential Lock 72

Housing and Output Shaft Assembly

Remove Output Shaft Assembly 74
Housing and Output Shaft Assembly - Parts Exploded View 75
Overhaul and Assemble Output Shaft Assembly 76
Measure and Adjust 78

Seals

Replace Seal 79
Service Kit 217414 80

IASS

Inter-Axle Speed Sensor - Parts Exploded View 81
Disassemble Inter-Axle Speed Sensor 82
Install Inter-Axle Speed Sensor 83

Housing Breather

Install New Axle Housing Breather
(Metal and Plastic) 84

Wheel End Seal

Wheel End Seal - Parts Exploded View 85
Remove and Overhaul Wheel End Seal 86

Wheel Adjustment Systems

Adjust Wheel Bearing 87

Wheel End

Verify Wheel End-play Procedure 89
Lubricate Wheel End 90
Wheel Ends Without Oil Fill Hole..... 91

Lubrication

General Lubrication Information 92
Lube Change Intervals 93
Change Lube 94
Standpipes 95

Towing

Proper Vehicle Towing 97

Theory of Operation

Power Divider Operation
(Power Flow and Torque Distribution) 98
Operate Wheel Differential Assembly 100
Wheel Differential Lock 101

Parts Identification

Power Divider - Parts Exploded View 103
Front Drive Axle - Parts Exploded View 104
Rear Drive Axle - Parts Exploded View 105
Inter-Axle Speed Sensor - Parts Exploded View 106
Housing and Output Shaft Assembly -
Parts Exploded View 107

Torque Chart

Fastener Torque Specifications 108

Introduction

Dana presents this publication to aid in maintenance and overhaul of Spicer single reduction drive axles.

Instructions contained cover the models listed below. Their design is common, with differences in load capacity. Capacity variations are achieved by combining basic differential carrier assemblies with different axle housings, axle shafts and wheel equipment.

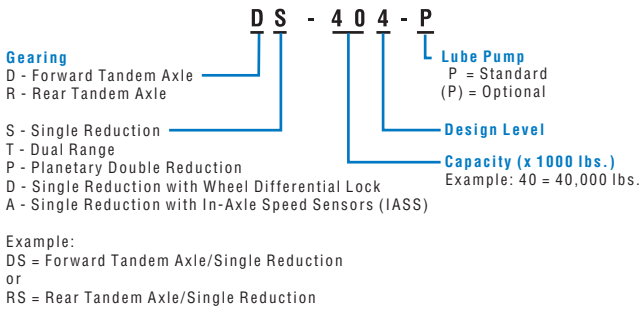
The suffix letter "P" in the model number indicates a lube pump is standard. Pump models are equipped with a gerotor pump, designed to provide additional lubrication to the inter-axle differential and related parts.

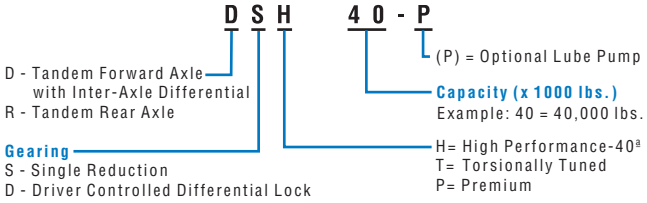
Model Listing

The following models are included in this publication.

FORWARD AXLE	REAR AXLE	FORWARD AXLE	REAR AXLE	LOAD CAPACITY
DS344	RS344			34,000 lbs.
DA344	RA344			
DS404(P)	RS404	DSP41	RSP41	40,000 lbs.
DA404(P)	RA404	DSH40	RSH40	
DD404(P)	RD404	DDH40	RDH40	
DS405(P)	RS405	DSH44	RSH44	
DS405(P)	RA405	DDH44	RDH44	
DD405(P)	RD405	DST40(P)	RST40	
DSP40	RSP40	DST41(P)	RSDT41	
		DDT41(P)		
DS454(P)	RS454	DD454(P)	RD454	45,000 lbs.
DA454(P)	RA454(P)			

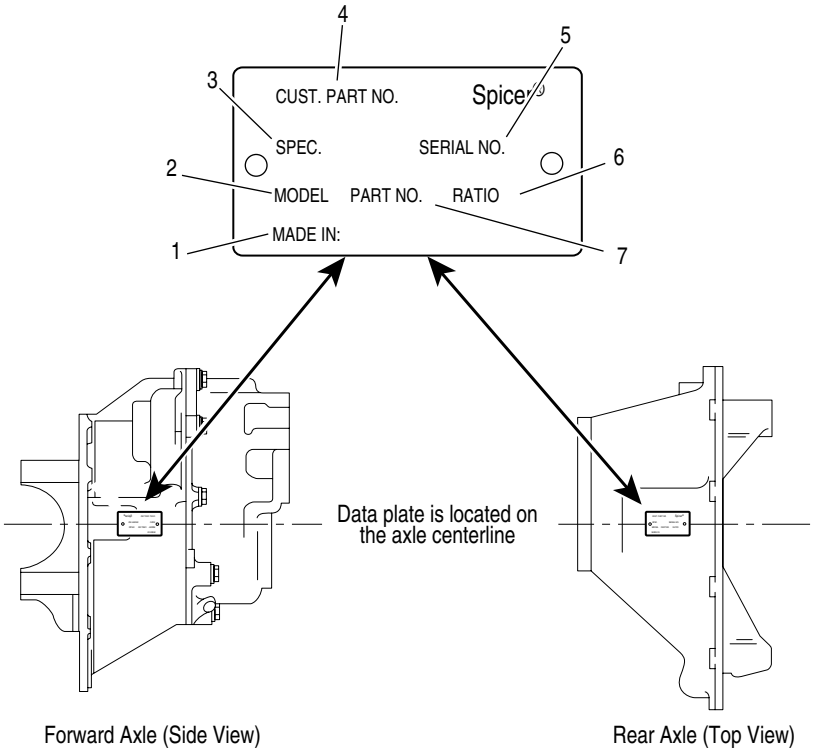
Model Information


D S - 4 0 4 - P
Gearing
D - Forward Tandem Axle
R - Rear Tandem Axle
S - Single Reduction
T - Dual Range
P - Planetary Double Reduction
D - Single Reduction with Wheel Differential Lock
A - Single Reduction with In-Axle Speed Sensors (IASS)
Lube Pump
P = Standard
(P) = Optional
Design Level
Capacity (x 1000 lbs.)
Example: 40 = 40,000 lbs.
Example:
DS = Forward Tandem Axle/Single Reduction
or
RS = Rear Tandem Axle/Single Reduction


D S H 4 0 - P
D - Tandem Forward Axle with Inter-Axle Differential
R - Tandem Rear Axle
Gearing
S - Single Reduction
D - Driver Controlled Differential Lock
(P) = Optional Lube Pump
Capacity (x 1000 lbs.)
Example: 40 = 40,000 lbs.
H= High Performance-40ª
T= Torsionally Tuned
P= Premium

Model Identification

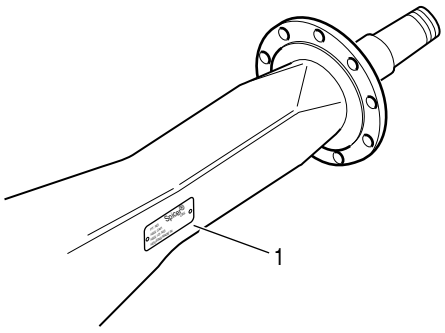
Drive Axle



1 - Country or origin
2 - Axle model identification
3 - Specification number assigned to the axle built by Spicer. Identifies all component parts of the axle including special OEM requirements such as yokes or flanges.
4 - OEM part number assigned to the axle build
5 - Carrier assembly serial number assigned by the manufacturing plant
6 - Axle gear ratio
7 - Carrier assembly production or service part number

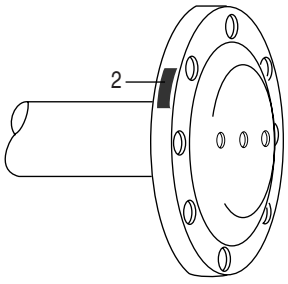
Parts Identification

Axle Housing



1 - ID Tag

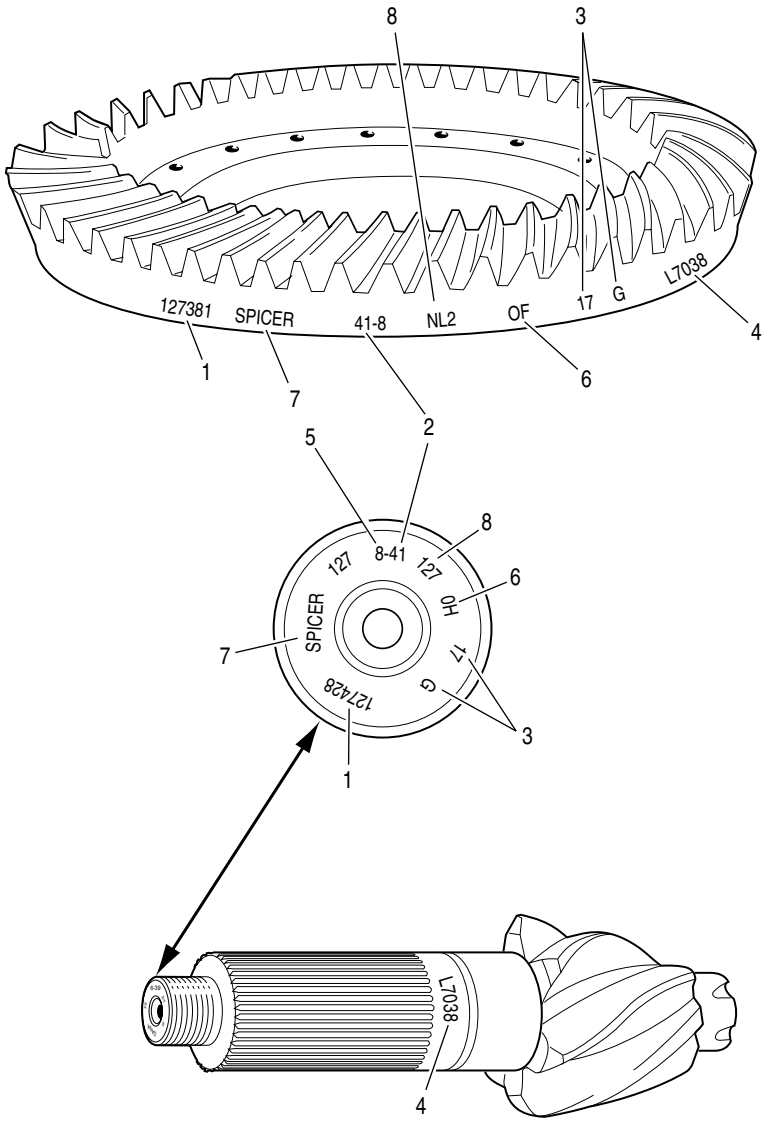
Axle Shaft



2 - Axle shaft part number

Ring Gear and Pinion

Note: Ring gear and drive pinion are matched parts and must be replaced in sets.



1—Part number
2—Number of ring gear teeth
3—Manufacturing numbers
4—Matching gear set number
5—Number of pinion teeth
6—Date code
7—Indicates genuine Spicer parts
8—Heat Code

Failure Analysis

Failure analysis is the process of determining the original cause of a component failure in order to keep it from happening again. Too often, when a failed component is replaced without determining its cause, there will be a recurring failure. If a carrier housing is opened, revealing a ring gear with a broken tooth, it is not enough to settle on the broken tooth as the cause of the carrier failure. Other parts of the carrier must be examined. For a thorough understanding of the failure and possible insight into related problems, the technician needs to observe the overall condition of the vehicle.

No one benefits when a failed component goes on the junk pile with the cause unknown. Nothing is more disturbing to a customer than a repeat failure. Systematically analyzing a failure to prevent a repeat occurrence assures quality service by avoiding unnecessary downtime and further expense to the customer.

The true cause of a failure can be better determined by knowing what to look for, determining how a piece of the equipment was running and learning about previous problems. In the case of a rebuilt rear axle, mismatched gears may have been installed.

The more successful shops prevent repeat equipment failures by developing good failure analysis practices. Knowing how to diagnose the cause of a premature failure is one of the prerequisites of a good heavy-equipment technician.

How to Diagnose a Failure
The following five steps are an effective approach to good failure diagnostics.

1. Document the problem.
2. Make a preliminary investigation.
3. Prepare the parts for inspection.
4. Find the cause of the failure
5. Correct the cause of the problem.

Document the Problem
Here are some guidelines for starting to learn about a failure, including questions to ask:

- Talk to the operator of the truck.
- Look at the service records.
- Find out when the truck was last serviced.
- Ask: In what type of service is the truck being used?
- Ask: Has this particular failure occurred before?
- Ask: How was the truck working prior to the failure?

You need to be a good listener. Sometimes, insignificant or unrelated symptoms can point to the cause of the failure.

- Ask: Was the vehicle operating at normal temperatures?
- Ask: Were the gauges showing normal ranges of operation?
- Ask: Was there any unusual noise or vibration?

After listening, review the previous repair and maintenance records. If there is more than one driver, talk to all of them and compare their observations for consistency with the service and maintenance records. Verify the chassis Vehicle Identification Number (VIN) number from the vehicle identification plate, as well as the mileage and hours on the vehicle.

Make a Preliminary Investigation
These steps consist of external inspections and observations that will be valuable when combine with the results of the parts examination.

- Look for leaks, cracks or other damage that can point to the cause of the failure.
- Make note of obvious leaks around plugs and seals. A missing fill or drain plug would be an obvious cause for concern.
- Look for cracks in the carrier housing (harder to see, but sometimes visible).
- Does the general mechanical condition of the vehicle indicate proper maintenance or are there signs of neglect?
- Are the tires in good condition and do the sizes match?
- If equipped with a torque-limiting device, is it working properly?

During the preliminary investigation, write down anything out of the ordinary for later reference. Items that appear insignificant now may take on more importance when the subassemblies are torn down.

Prepare the Parts for Inspection

After the preliminary investigation, locate the failure and prepare the part for examination. In carrier failure analysis, it may be necessary to disassemble the unit.

- When disassembling subassemblies and parts, do not clean the parts immediately since cleaning may destroy some of the evidence.
- When tearing down the drive axle, do it in the recommended manner. Minimize any further damage to the unit.
- Ask more questions when examining the interior of the carrier. Does the lubricant meet the manufacturer specifications regarding quality, quantity and viscosity? As soon as you have located the failed part, take time to analyze the data.

Find the Cause of the Failure
Here begins the real challenge to determine the exact cause of the failure. Keep in mind that there is no benefit to replacing a failed part without determining the cause of the failure. For example, after examining a failed part and finding that the failure is caused by a lack of lubrication, you must determine if there was an external leak. Obviously, if there is an external leak, just replacing the failed gear is not going to correct the situation.

Another important consideration here is to determine the specific type of failure which can be a valuable indicator for the cause of failure. The following pages show different types of failures and possible causes. Use this as a guide in determining types of failures and in correcting problems.

Correct the Cause of the Problem
Once the cause of the problem has been determine, refer to the appropriate service manual to perform the repairs.

Inspection

Clean

1. Wash steel parts with ground or polished surfaces in solvent. There are many suitable commercial solvents available. Kerosene and diesel fuel are acceptable.

⚠ WARNING

Gasoline is not an acceptable solvent because of its extreme combustibility. It is unsafe in the workshop environment.

2. Wash castings or other rough parts in solvent or clean in hot solution tanks using mild alkali solutions.

Note: If a hot solution tank is used, make sure parts are heated thoroughly before rinsing.

3. Rinse thoroughly to remove all traces of the cleaning solution.
4. Dry parts immediately with clean rags.
5. Oil parts.
   - If parts are to be reused immediately: Lightly oil.
   - If parts are to be stored: Coat with oil, wrap in corrosion resistant paper and store in a clean, dry place.

Inspect Axle Housing
Axle housing inspection and repairs are limited to the following checks or repairs.

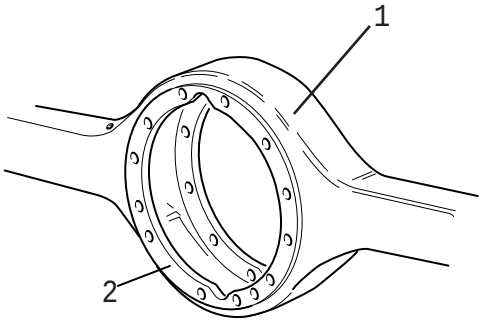
- Visually inspect axle housing for cracks, nicks and burrs on machined surfaces.
- Check carrier bolt holes and studs for foreign material.
- Replace damaged fasteners. Look for loose studs or cross threaded holes.

⚠ CAUTION

Any damage which affects the alignment or structural integrity of the housing requires housing replacement. Do not repair by bending or straightening. This process can affect the material's properties and cause it to fail completely under load.

- Check all seals and gaskets.

Note: Replace conventional gaskets with silicone rubber gasket compound (included in many repair kits). The compound provides a more effective seal against lube seepage and is easier to remove from mating surfaces when replacing parts.



1 - Axle Housing
2 - Machined surface

Inspect Components
Inspect all steel parts for:

- Notches, visible steps or grooves created by wear
- Pitting or cracking along gear contact lines
- Scuffing, deformation or discolorations. These are signs of excessive heat in the axle and are usually related to low lubrication levels or improper lubrication practices.

In addition, inspect the following for damage:

- Differential gearing
- Bearings for loose fit on drive pinion, pilot bearing, and differential bearings
- All fasteners for rounded heads, bends, cracks or damaged threads.
- Inspect machined surfaces of cast or malleable parts. They must be free of nicks, burrs, cracks, scoring, and wear.
- Look for elongation of drilled holes, wear on surfaces machined for bearing fits and nicks or burrs in mating surfaces.

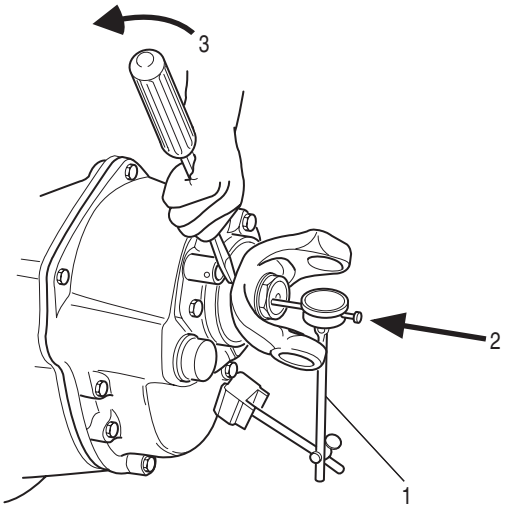
Inspect Primary Gearing
Before reusing a primary gear set, inspect teeth for signs of excessive wear. Check tooth contact pattern for evidence of incorrect adjustment.

Check Input Shaft End-play (Forward Axle)

Note: Before disassembling the power divider, measure and record input shaft end-play.

See illustration for steps 1–3.

1. Position dial indicator at yoke end of input shaft.
2. Push in on input shaft and zero the dial indicator.
3. Using a pry bar, move input shaft axially and measure/record end-play.



Adjustment
Correct end-play for a new assembly is .003" to .007". The maximum end-play for a used assembly is no more than .014". If end-play is incorrect, determine shim pack changes as follows:

Add shims to increase end-play.

Desired end-play (New Parts)	*0.003” to 0.007”*
Measured end-play (Step 3)	*0.001” – 0.001”*
Add shims to provide desired end-play	*0.002” to 0.006”*

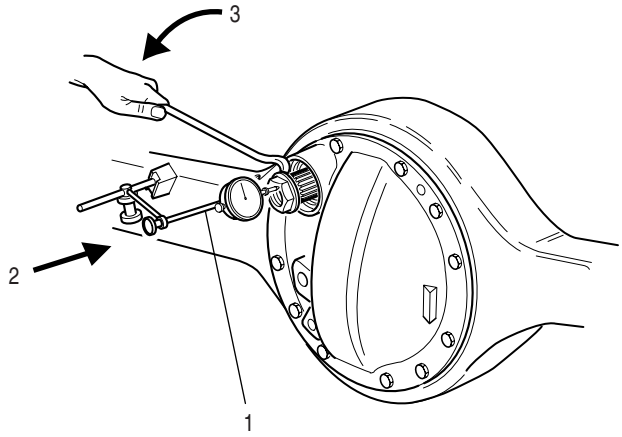
Remove shim to decreased end-play.

Measured end-play (Step 3)	*0.015” – 0.015”*
Desired end-play (New Parts)	*0.003” to 0.007”*
Remove shims to provide desired end-play	*0.012” to 0.008”*

Check Output Shaft End-play (Forward Axle)

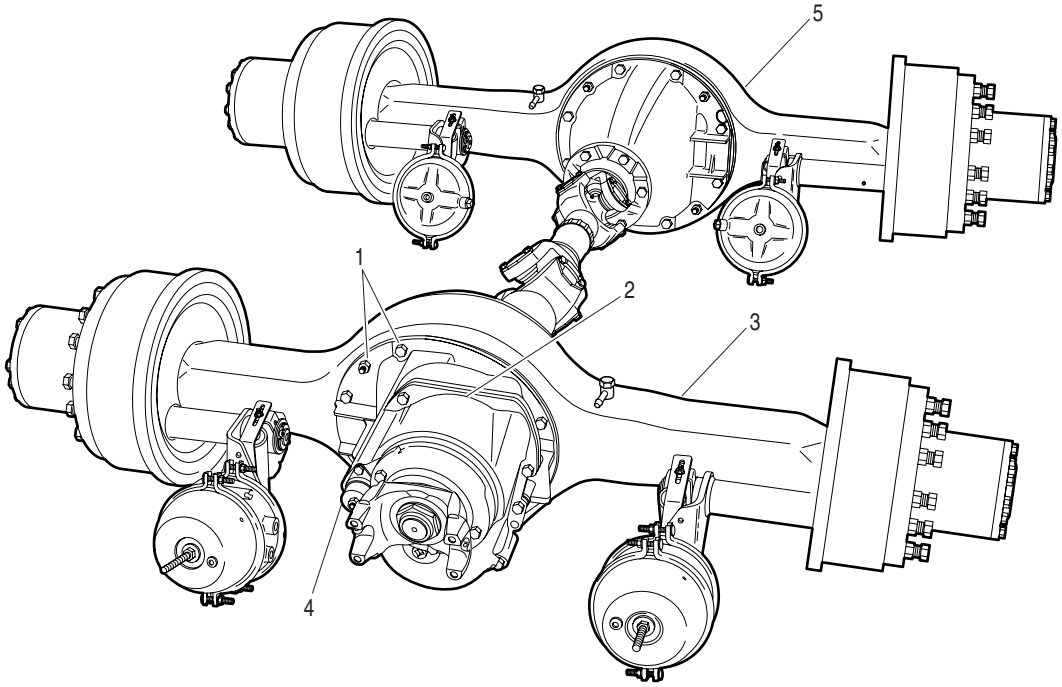
See illustration for steps 1–3.

1. Position dial indicator at yoke end of output shaft.
2. Push in on output shaft and zero the dial indicator.
3. Using a pry bar, move input shaft axially and measure/record end-play.



Adjustment
Correct end-play for a new assembly is .001" to .015". The maximum end-play for a used assembly is no more than .015". If end-play is incorrect, contact Dana.

Differential Carrier Assembly - Parts



1—Carrier fasteners
2—Carrier assembly
3—Forward axle assembly
4—Inter-axle differential lockout
5—Rear axle assembly

Remove Differential Carrier (Forward and Rear)

Note: The removal of the forward carrier does not require disconnecting of the inter-axle driveline and removal of the output shaft yoke assembly as most other Spicer tandems require.

Standard Differentials

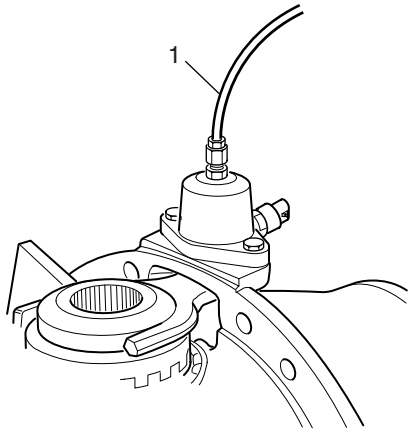
1. Block the vehicle.
2. Drain axle lubricant.
3. **Rear Only:** Disconnect inter-axle driveline.
4. **Front Only:** Disconnect main driveline.
5. **Front Only:** Disconnect differential lockout air line.
6. Disconnect lead wires to the selector switch and air line at shift cylinder.
7. Remove axle shafts.

Diff-Lock Models

For removal of the locking wheel differential carrier assembly, the differential lock must be engaged and held in the engaged position. This can be accomplished by one of two methods; either engage via air pressure or engage manually.

Engage via Air Pressure

a. Using an auxiliary air line, apply 80–120 PSI air pressure to shift cylinder air port to engage clutch.

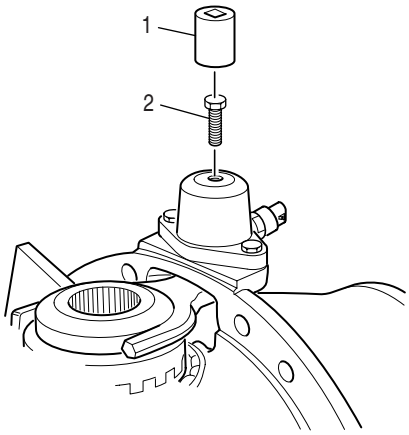


1—Connect 80-120 PSI air line to cylinder port

Engage Manually

a. Install a .250 – 18 NPTF bolt over 1.5" long in the cylinder air port to manually engage the clutches. GM models require a M12 X 1.5 X 38mm bolt.

Note: Hand-tighten the bolt, over-torquing may cause damage to the shift unit. To facilitate hand-tightening, coat bolt threads with axle lube.



1—Hand tighten with socket
2—M12 x 1.5 x 38mm bolt – GM only .250 – 18 NPTF – all models except GM

Note: With either method, the axle shaft may have to be rotated to permit the clutch to become engaged.

⚠ WARNING

Do not lie under carrier after fasteners are removed. Use transmission jack to support differential carrier assembly prior to loosening fasteners.

8. To remove axle shaft, remove axle stud nuts. (If used, remove lock washers and taper dowels.)
9. Remove axle shafts.

Note: All models in this publication use axle shafts with unequal lengths. Axle shafts may also be location specific with various wheel equipment. Do not misplace axle shafts from their intended location. Identify left and right shafts for reference during reassembly.

TIP: If necessary, loosen dowels by holding a brass drift in the center of the shaft head and striking drift a sharp blow with a hammer.

⚠ CAUTION

Do not strike the shaft head with a steel hammer. Do not use chisels or wedges to loosen shaft or dowels.

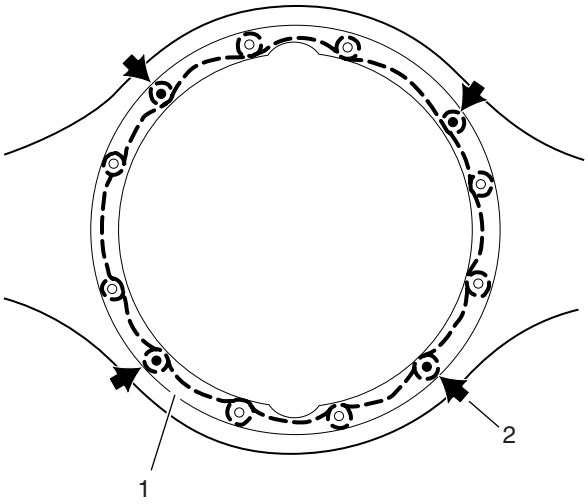
10. Remove carrier capscrews, nuts and lock washers.
11. Remove differential carrier assembly.

Install Differential Carrier (Forward and Rear)

⚠ IMPORTANT

Before installing carrier assembly, inspect and thoroughly clean interior of axle housing using an appropriate solvent and clean rag.

1. Apply Spicer approved RTV compound on axle housing mating surface as shown in the illustration. Completely remove all old gasket material prior to applying new material. Compound will set in 20 minutes. Install carrier before compound sets or reapply.



1— Apply silicone gasket in this pattern
2— Common stud locations

TIP: To assist in installing complete differential carrier use two pieces of threaded rod (M16 X 1.5) threaded into carrier capscrew holes. Rod should be approximately 6" long. Use these to pilot the carrier into the housing.

2. Install carrier to housing, lock washers, capscrews and nuts. Torque to proper specification. Torque to 230–270 lbs. ft. (312–366 N•m).
3. After 11/02/98, axle housing covers are welded in place. If you have a bolt-on cover, install rear housing cover/output shaft assembly (see page 69). Torque all fasteners to proper specifications. Torque to 85–103 lbs. ft. (115–140 N•m). Install inter-axle driveline making sure yokes are in phase.
4. Install axle shafts and axle stud nuts (if used, also install lock washers and tapered dowels).
5. Add axle lubricant. Fill to bottom of filler hole.
6. **Rear Only:** Connect inter-axle driveline, making sure all yokes are in phase. Lubricate U-joints.
7. **Front Only:** Connect main driveline, making sure all yokes are in phase. Lubricate U-joints.
8. **Front Only:** Connect differential lockout air line.

Inter-Axle Lockout Types

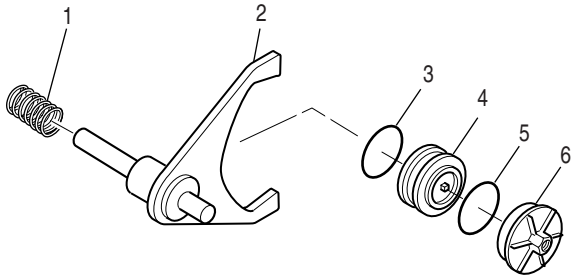
Since 1992, there have been 5 different power divider air lockout designs that are identified for service as either:

- External - all models produced BEFORE 11/02/98
- Integral - all models produced AFTER 11/02/98

All are air-operated to engage the lockout and spring-released to disengage the lockout with the exception of the "Reverse-Air" lockout. The "Reverse-Air" lockout is spring-released to engage the lockout and air-operated to disengage the lockout.

Integral Shift Cylinder with Welded Push Rod Assembly—February 2, 2000 to Present

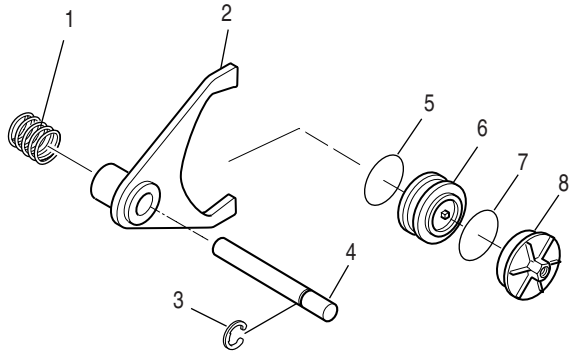
- Redesigned shift system recessed into PDU cover.
- Integral



1 - Compression spring
2 - Shift fork
3 - O-ring
4 - Piston
5 - O-ring
6 - Piston Cover

Integral Shift Cylinder—November 2, 1998 to February 2, 2000

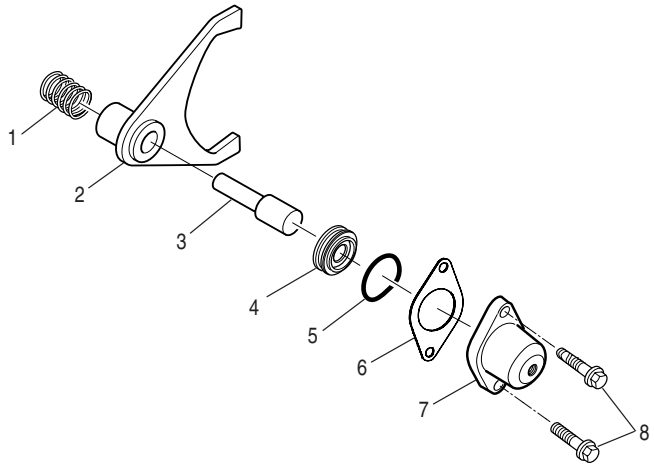
- Redesigned shift system recessed into PDU cover.
- Integral



1 - Compression spring
2 - Shift fork
3 - Snap ring
4 - Push rod
5 - O-ring
6 - Piston
7 - O-ring
8 - Piston Cover

Cast Iron Cover Lockout—February 1996 to November 1998

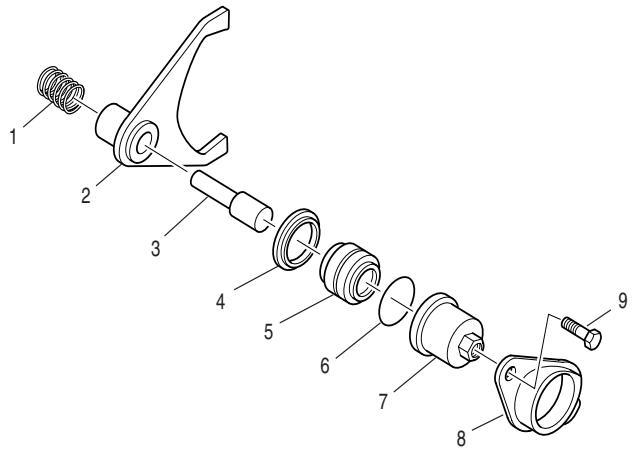
- External type lockout.
- Cast iron piston cover.



1 - Compression spring
2 - Shift fork
3 - Push rod
4 - Piston
5 - O-ring
6 - Gasket
7 - Piston cover
8 - Hex head capscrew with flange

Cylindrical Design Lockout—
November 1992 to February 1996

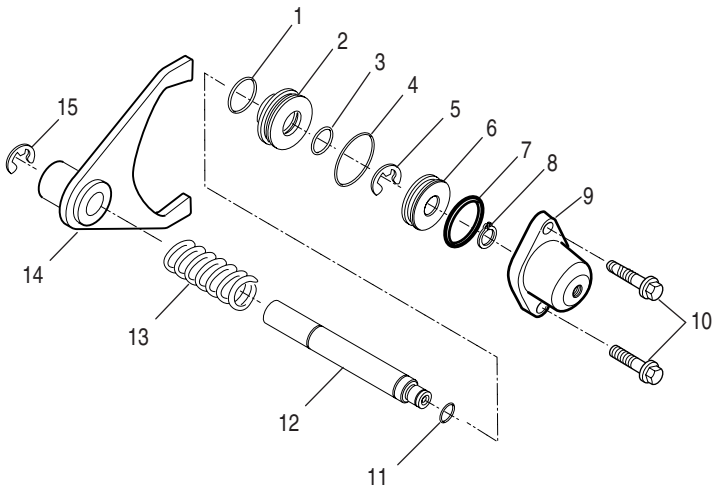
- External type lockout
- Stamped steel piston cover.
- Interchangeable with the cast style cover only as a complete assembly.



1 - Compression spring
2 - Shift fork
3 - Push rod
4 - Shoulder washer
5 - Piston
6 - O-ring
7 - Shift cylinder
8 - Mounting bracket
9 - Mounting bracket capscrews

"Reverse-Air" Lockout—Navistar before November 1, 1996

- External type lockout.
- Cast iron piston cover.



1—O-ring
2—Pilot plate
3—O-ring
4—O-ring
5—Snap ring
6—Piston
7—O-ring
8—Snap ring
9—Piston cover
10— Hex head capscrew with flange
11— O-ring
12— Push rod
13— Compression spring
14— Shift fork
15— Snap ring

Remove Lockout

External Type Lockout

1. With axle installed in vehicle, place differential lock selector valve in the disengaged (or unlocked) position.
2. Disconnect differential lockout air line.
3. Remove capscrews.
4. Remove shift cylinder body or cast iron cover, o-ring and piston.

⚠ IMPORTANT

Do not remove push rod. Removal of push rod will result in shift fork and compression spring falling into power divider unit. If this occurs, disassembly of the power divider assembly will be necessary.

5. Remove shoulder washer in cylindrical design lockouts. Cast iron cover lockout designs do not use a shoulder washer.

Note: Cylindrical design lockout and cast iron cover lockout are interchangeable only as complete assemblies.

Integral Type Lockout

1. With axle installed in vehicle, place differential lock selector valve in the disengaged (or unlocked) position.
2. Disconnect differential lockout air line.
3. Remove piston cover and o-ring.
4. Remove piston and o-ring assembly with pliers.

Note: To remove shift fork and push rod parts, the power divider must be removed. See power divider section.

Install Lockout

External Type Lockout

1. Assemble o-rings onto piston. Apply silicone grease to o-ring.
2. Install piston and o-ring assembly into cylinder body or cast iron cover.
3. Attach shift cylinder body or cast iron cover to power divider while aligning piston with push rod. Make sure shoulder washer or gasket is in place.
4. For stamped steel style lockouts, attach mounting bracket to cylinder body and secure capscrews.
5. Tighten capscrews to 28–35 lbs. ft. (38–47 N•m).
6. Connect differential lockout air line.
7. Cycle the lockout unit to insure there are no leaks and system shifts freely.

Integral Type Lockout

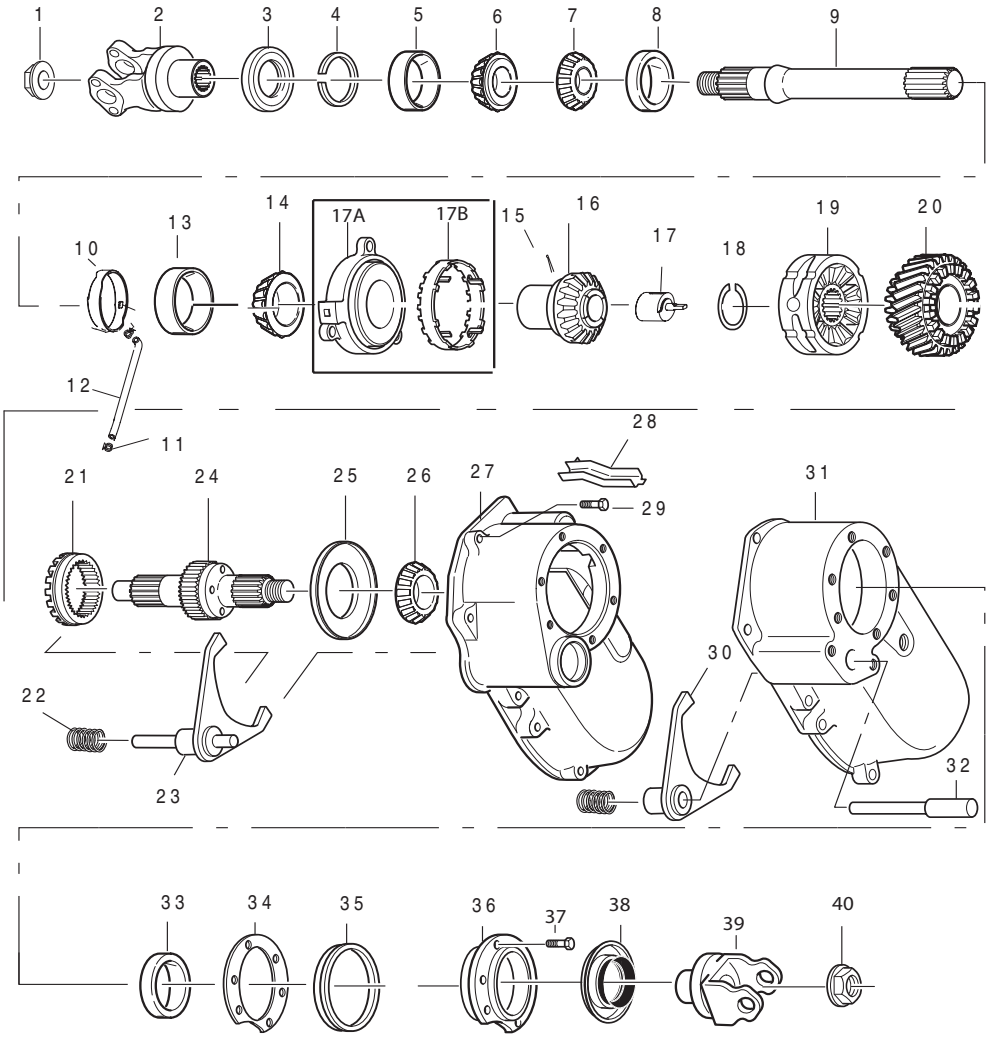
1. Assemble o-rings onto piston and piston cover. Apply silicone grease to o-rings.
2. Gently push piston and o-ring assembly into lockout cylinder recess. Make sure piston is pushed all the way in.
3. Install piston cover and o-ring assembly. Start by hand tightening clockwise.

⚠ CAUTION

Do not to strip threads or use excessive force, damage to part may occur.

4. Tighten piston cover to 25-35 lbs. ft. (35-47 N•m).
5. Connect differential lockout air line.
6. Cycle the lockout unit to make sure there are no leaks and the system shifts freely.

Power Divider - Parts Exploded View



1 —Output shaft nut
2 —Output yoke
3 —Output seal
4 —Output shaft bearing snap ring
5 —Outer bearing cup
6 —Outer bearing cone
7 —Inner bearing cone
8 —Inner bearing cup
9 —Output shaft
10 —Seal manifold assembly
11 —Sump screen
12 —Seal manifold feed tube
13 —Output side gear bearing cup
14 —Output side gear bearing cone
15 —Pump locking Pin
16 —Output side gear
17 —Pump
17A ---Old style pump
17B—Output side gear bearing cup
18—Snapping ring
19 —Inter-axle differnential
20 —Helical side gear
21 —Sliding clutch
22 ---Push rod spring
23—Shift fork assembly
24 —Input shaft
25 —Input shaft oil retainer
26 —Input shaft bearing cone
27 —Power divider cover (integral)
28 —Lube trough
29 —Capscrew
30 ---Shift fork
31 —Power divider cover (Old style)
32 —Push rod
33 —Input bearing cup
34 —Input cage shim
35 —Input cage V-ring
36 —Input cage
37 —Capscrew
38 —Oil seal
39 —Input yoke
40 —Input nut

Remove Power Divider

Assemblies built BEFORE 11/02/98

Power Divider Interchangeability (D344/404/405/454 Models Only)

Note: Due to the 11/02/98 redesign of the power divider (integral air lockout and lube trough), the ability to interchange parts will vary by build.

- **Pre-11/02/98** carriers **cannot** be rebuilt with current design power divider unit's parts that have the integral air lockout design and lube trough.
- **11/02/98-current** models **can** be rebuilt using pre-11/02/98 power divider parts.

For more information refer to Spicer Bulletin ABIB-9901.

The power divider can be replaced with the axle assembly both in or out of the chassis and with the differential carrier assembled to the axle housing.

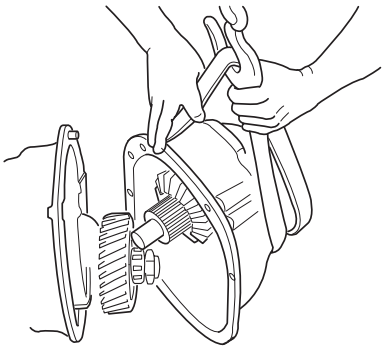
⚠ CAUTION

During removal of power divider cover, the inter-axle differential (IAD), input shaft assembly or IAD shift system parts may fall from the carrier if not careful. Use caution to prevent injury or damage.

1. Disconnect the main driveline.
2. Disconnect the lockout air line.
3. If overhauling the power divider, loosen but do not remove input nut.
4. Position a drain pan under the unit.
5. Remove PDU capscrews.

Method A
With Carrier Installed in Chassis

1. Use a transmission jack or a chain hoist and a sling.
2. Wrap sling strap around power divider and attach to chain hoist hook.



3. Tap on the sides of the cover at the dowel pins with a mallet to create a space large enough to finish freeing the cover from the dowel pins.
4. Pull the power divider forward until the input shaft stub end is free of the output side gear, then remove the assembly.

Method B
With Carrier Out of Chassis

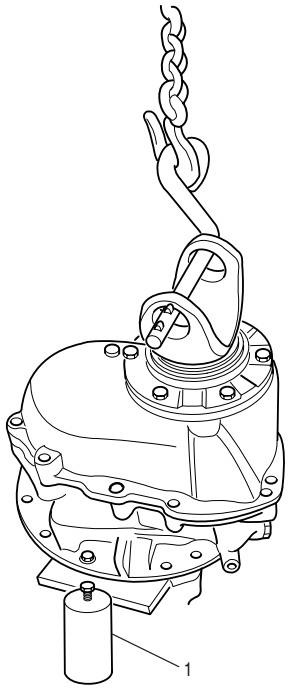
1. Use a chain hoist.
2. Mount carrier assembly in carrier assembly stand.
3. Remove PDU capscrews.
4. Fasten chain or strap to input yoke to remove power divider.

⚠ CAUTION

During removal of power divider cover, the inter-axle differential (IAD), input shaft assembly or IAD shift system parts may fall from the carrier if not careful. Use caution to prevent injury or damage.

Note: Lifting mechanism may create nicks and burrs on input yoke. Remove nicks and burrs if present.

5. Tap the sides of the cover at the dowel pin location with a mallet to loosen cover.



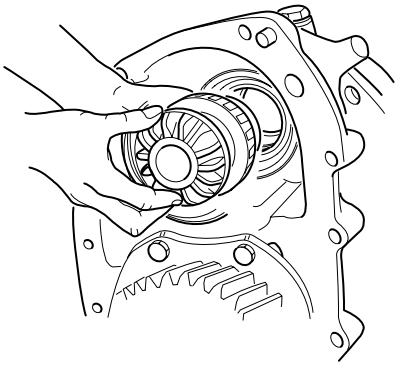
1 - Carrier assembly stand

Disassemble, Assemble and Overhaul the Power Divider

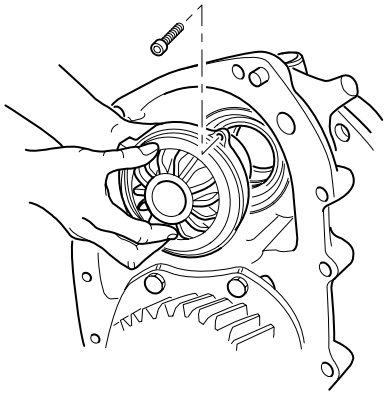
Assemblies built BEFORE 11/02/98
The power divider may be serviced with the carrier assembly in or out of the axle housing.

Note: The following procedure assumes that the differential carrier has been removed from the axle housing and that the power divider has been removed from the carrier assembly.

1. Remove output shaft side gear from differential carrier.



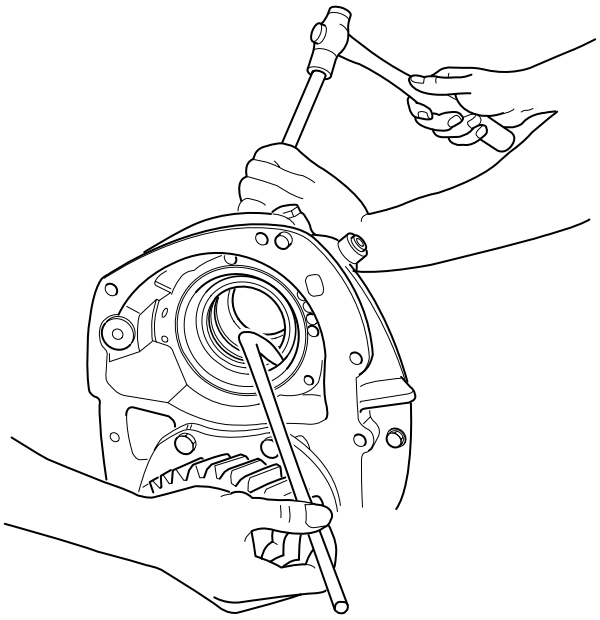
Note: On pump models it will be necessary to remove three pump retaining screws and remove the pump and output shaft side gear as an assembly.



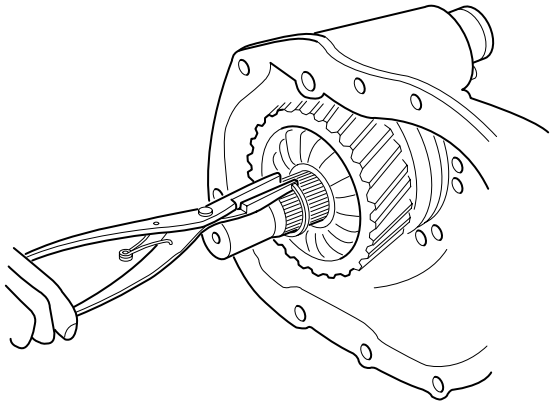
2. If replacement of the output shaft side gear bearing cup is necessary, use either of the following methods:

   Weld: Place a weld bead around the inside of the cup, when the weld cools the cup will fall out.

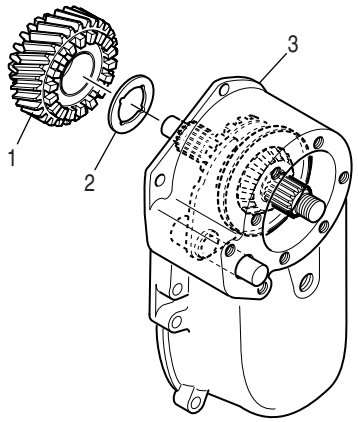
   Hammer: Use slipper to get under the cup and with a hammer and drift from the back side of carrier tap out bearing cup.



3. Remove snap ring from machined groove at rear of input shaft.



4. Slide helical side gear off input shaft.
5. Remove helical side gear thrust washer.

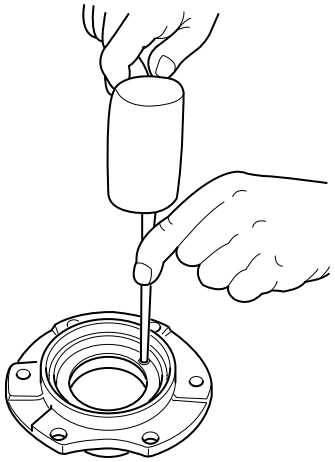


1—Helical side gear
2—Thrust washer
3—PDU Cover (after 11/02/98)

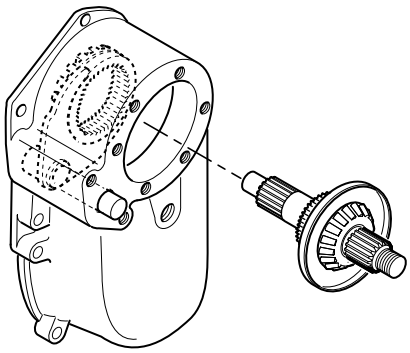
6. Remove input shaft nut.
7. Remove yoke from input shaft using a puller tool.

   TIP: A yoke puller tool may be made from the center section of most gear puller tools, or may be purchased from your local tool distributor.

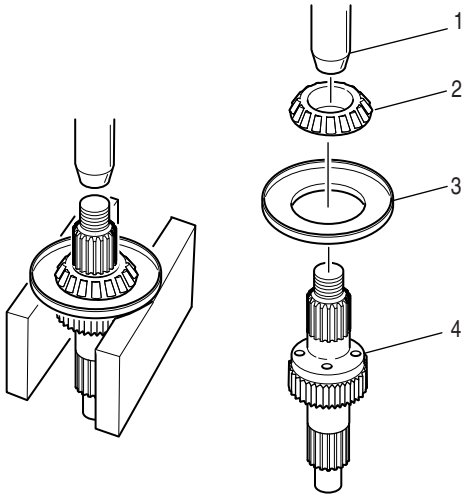
8. Remove capscrews, input bearing cover and shim pack.
9. If input shaft bearing cup needs replacement, use either of the following recommended practices:
   - Weld a bead around the cup, when the weld cools the cup will fall out.
   - Drill a 1/4 size hole through the bearing cover to the back side of the cup and use a punch to remove the bearing cup.



10. Slide input shaft assembly out of cover.



11. Remove input shaft bearing cone and oil retainer.



1—Press
2—Bearing
3—Oil retainer
4—Input shaft

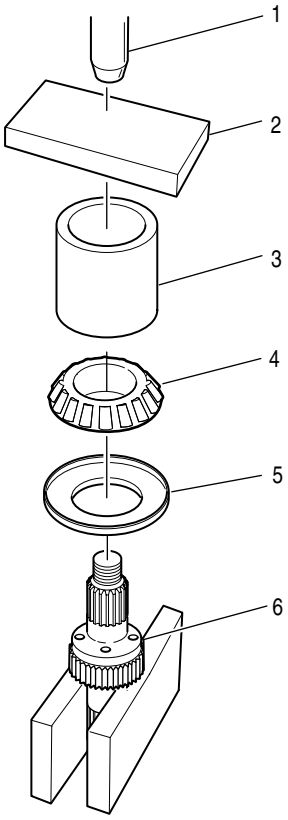
Note: Shift fork cannot be removed until lockout cover is removed and push rod is removed from shift fork. See Differential Lockout Section.

12. Press new oil retainer on input shaft.

⚠ CAUTION

It is not recommended to reuse the oil retainer due to possible damage that may occur while removing the input shaft bearing cone. While pressing on new oil retainer, make sure not to over press, and/or press with the retainer at an angle. If the retainer is bent or distorted it may rub on the input cage or not seal properly to the v-ring.

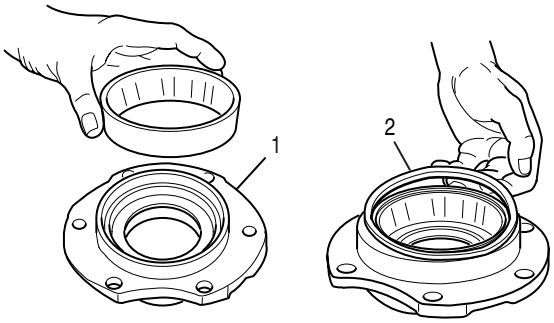
13. Press input bearing cone on input shaft.



1—Press
2—Plate
3—Drive sleeve
4—Input shaft bearing cone
5—Oil retainer
6—Input shaft

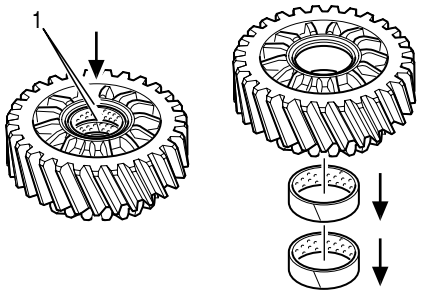
14. Press bearing cup in input bearing cover.

15. Install oil v-ring on input bearing cage cover.



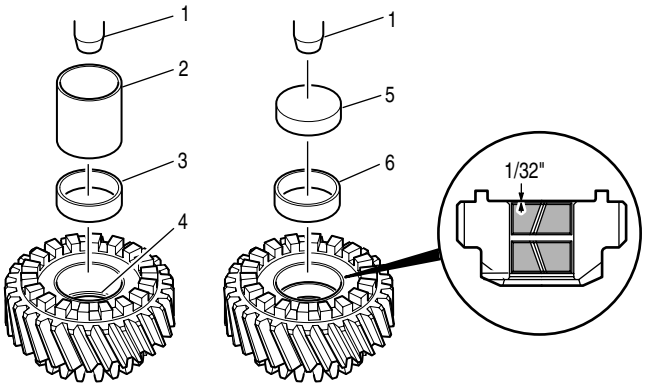
1—Bearing cup (press)
2—V-ring

16. If bushing removal is needed, the bushings must exit from the thrust washer side of the helical gear.



1—Tap out bronze bushings

17. Install bronze bushing in helical side gear. **Bushings must be installed from thrust washer side of gear.** See illustration for dimensional tolerances.



1—Press
2—Sleeve
3—1st bronze bushing (press to shoulder)
4—Shoulder
5—Sleeve
6—Second bronze bushing (recess 1/32”)

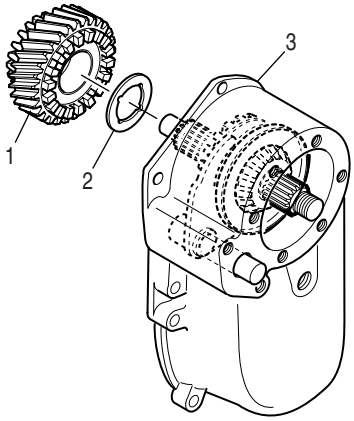
18. Install shift fork, spring and push rod in cover assembly, if removed.

19. Units with reverse air, install snap ring fork, spring and push rod in cover assembly, if removed.

20. Install lockout cylinder assembly if removed. Some models may have a one piece cover. Refer to pages 14-17. Tighten capscrews to 28–35 lbs. ft. (38–47 N•m).
21. Place sliding clutch in power divider cover, engaging clutch with shift fork. Position clutch teeth toward helical side gear.
22. Slide input shaft into power divider cover. Engage shaft splines in lockout sliding clutch.
23. Install input bearing cover and shims.

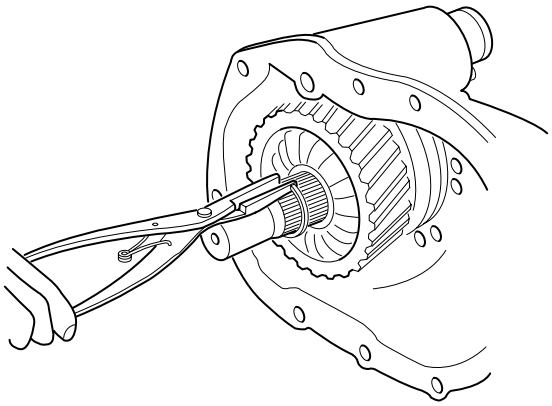
Note: Input shaft end-play must be adjusted after power divider is assembled to differential carrier. For easier adjustment, temporally install input bearing cage cover and tighten capscrews finger tight.

24. Install helical thrust washer over input shaft.
25. Install helical side gear.



1—Helical side gear
2—Helical side gear thrust washer
3—PDU cover (before 11/02/98)

26. Install snap ring.



⚠ WARNING

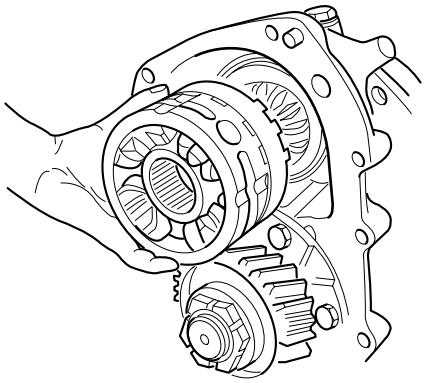
Snap ring is spring steel and may pop off. Wear safety glasses when installing.

Remove Lube Pump

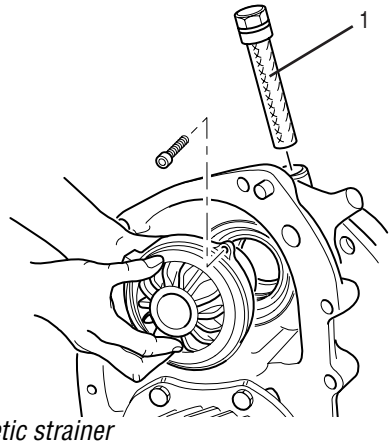
1. Remove inter-axle differential (IAD) and pump collar.

   TIP: The output shaft side gear and pump will be removed as an assembly. The lube pump assembly is located on the back side of the output shaft side gear, between the output shaft side gear and bearing cone.

Note: If the IAD assembly is to be reused, install in same direction as removed.



2. Remove the three pump retaining screws and remove the pump and output shaft side gear as an assembly.



1—Magnetic strainer

3. Inspect the lube pump if metal particles are found in axle assembly.
4. Remove the magnetic strainer from the carrier and inspect for wear material in the same manner as the drain plug. Wash the magnetic strainer in solvent and blow dry with compressed air to remove oil and metal particles.

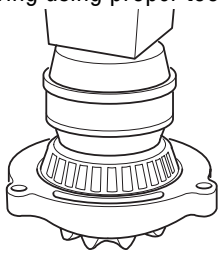
Note: The pump assembly must turn freely by hand. The pump is non-serviceable and must be replaced as a complete assembly.

Install Lube Pump

1. Install lube pump assembly onto output side gear.

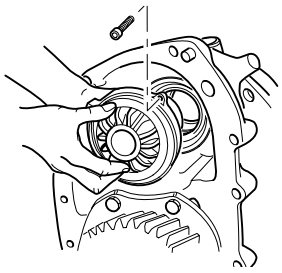
Note: The lube pump assembly is a slip-fit on the output shaft side gear, behind the press fit of the output shaft side gear bearing. The output shaft side gear bearing cone positions the pump assembly into the carrier.

2. Install bearing cone on output side gear.
3. Press bearing using proper tools until fully seated.



4. Reinstall output side gear pump and bearing assembly into carrier.
5. Tighten lube pump retaining screws to 17-21 lbs. ft. (23-38 N•m).

   TIP: The lube pump assembly is orientated in such a way that the three mounting/locating tabs will only line up one way.



Note: The lube pump is driven off the IAD assembly through a drive coupling. The drive coupling has drive tangs to both the IAD assembly and the lube pump. The IAD has notches that will accept the drive coupling on either face.

6. Install pump drive coupling.

Note: If reusing the IAD assembly, install in same direction as removed.

7. Reinstall IAD.

⚠ CAUTION

Exercise care to direct compressed air into a safe area. Wear safety glasses.

Install Power Divider to Carrier Assembly

Assemblies built BEFORE 11/02/98
(In vehicle installations shown)

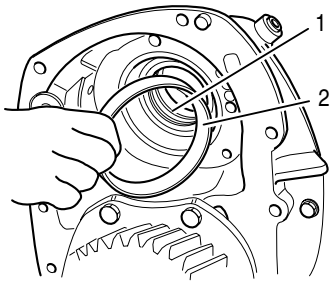
Note: Cleanliness in your work area is important as dirt is an abrasive and will cause premature wear of the otherwise serviceable parts.

Note: It is assumed that the differential carrier is secured in a stand, or the power divider only is being serviced while the axle is still attached to the housing.

⚠ CAUTION

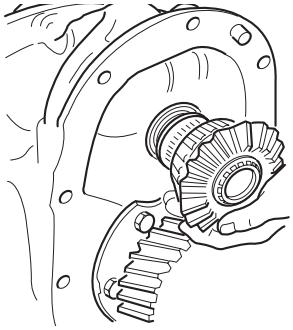
During installation of power divider cover, the inter-axle differential (IAD), input shaft assembly or IAD shift system parts may fall from the carrier if not careful. Use caution to prevent injury or damage.

1. Make sure dowel pins are installed in carrier.
2. Install output side gear bearing cup, if removed. Press bearing cup in carrier. Use a press and an appropriate sleeve. Make certain bearing cup is evenly and firmly seated. If a press is not available, use a sleeve or a bearing driver tool and a hammer to install the cup.
3. Lubricate o-rings.

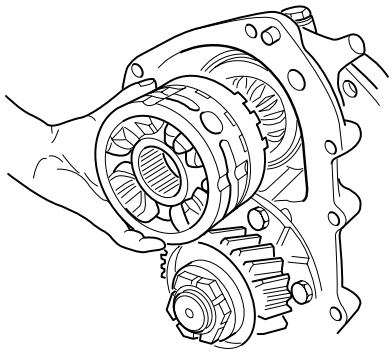


1—O-rings
2—Bearing cup

4. Install the output side gear if removed.



5. Install the IAD assembly to the output side gear. If reusing the IAD assembly, install in the same direction as removed.



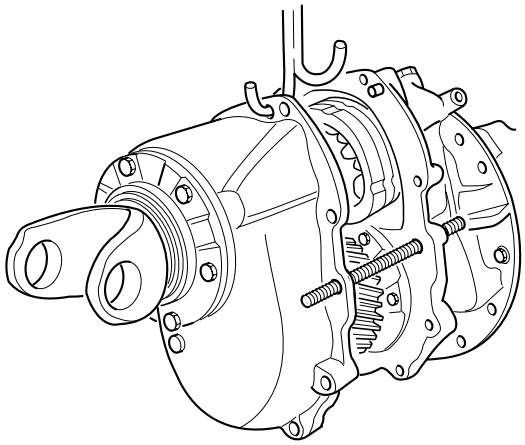
Note: For lube pump models, see instructions on page 24.

⚠ IMPORTANT

If power divider was manufactured before 11/02/98, the complete power divider assembly can be installed as one unit. It can be lifted or lowered into place with the input cage, input shaft, thrust washer, helical side gear and snap ring assembled to the PDU cover.

TIP: The use of two guide pins in the carrier mating surface will help align the PDU cover and aid in installation. Guide pins may be made from M14 X 2 bolts approximately 4 inches long with the heads removed.

6. Install power divider assembly to carrier assembly. Use Spicer approved RTV compound on the carrier mating surface.



⚠ CAUTION

During installation of power divider cover, the inter-axle differential (IAD), input shaft assembly or IAD shift system parts may fall from the carrier if not careful. Use caution to prevent injury or damage.

7. During installation rotate input shaft to engage input shaft splines with inter-axle differential. After installation, the output shaft should turn when the input shaft is rotated and output shaft should turn independently from the input shaft.

Note: Gasket compound will harden in 20 minutes. Install power divider as quickly as possible to avoid future leaks.

8. Install power divider capscrews. Torque to 114–140 lbs. ft. (155–190 N•m)
9. Reinstall input yoke if removed. All yokes have a slip to interference fit on spline. Yokes should always be installed with a press on tool to ensure they are fully seated.
10. Even though you may have checked the input shaft end-play before, you must check and adjust it again now.

Disassemble, Assemble and Overhaul Power Divider

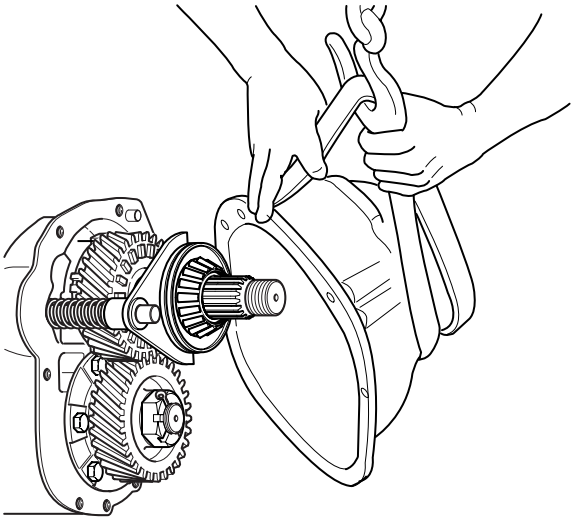
Assemblies built AFTER 11/02/98 (In Vehicle)
The power divider cover comes off as a unit followed by the input shaft and then the helical side gear.

The power divider can be replaced with the axle assembly both in or out of the chassis and with the differential carrier assembled to the axle housing.

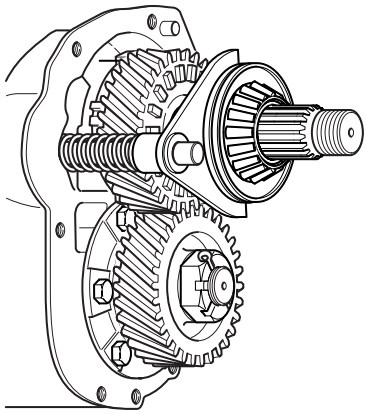
⚠ CAUTION

During removal of power divider cover, the inter-axle differential (IAD), input shaft assembly or IAD shift system parts may fall from the carrier if not careful. Use caution to prevent injury or damage.

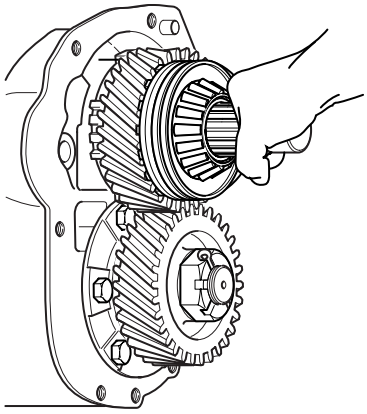
1. Disconnect the main driveline.
2. Disconnect the lockout air line.
3. Remove input yoke.
4. Remove input seal.
5. Position a drain pan under the power divider unit.
6. Remove PDU capscrews.
7. Remove power divider cover.



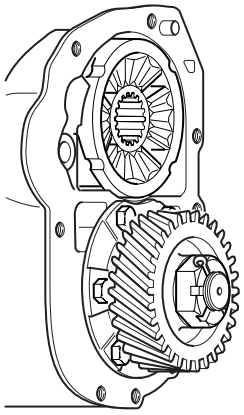
8. Remove shift fork, compression spring and shift rod.



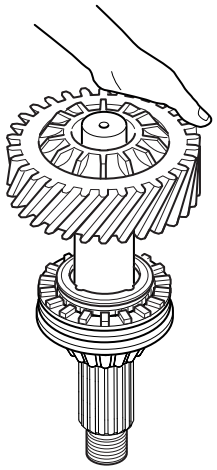
9. Remove **input shaft drive assembly** from the carrier.



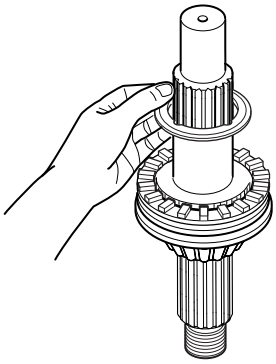
10. Remove the IAD assembly from the output side gear.



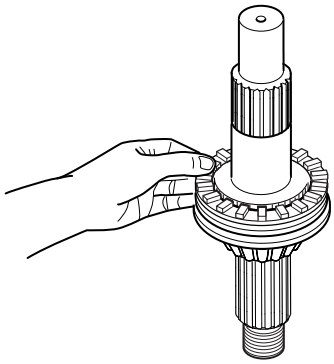
11. Remove helical side gear and snap ring.



12. Remove thrust washer.

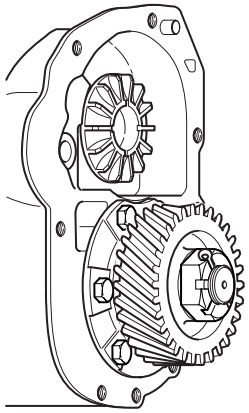


13. Remove lockout sliding clutch from the input shaft.

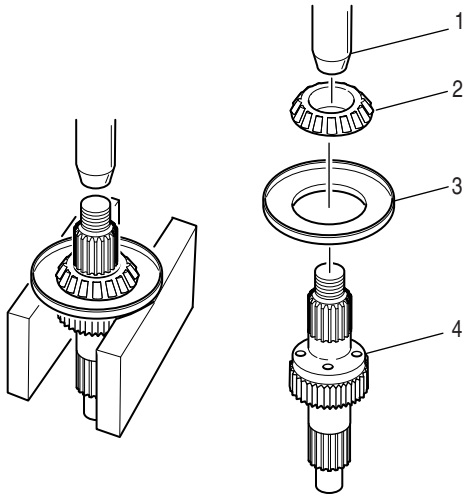


14. Remove the output side gear.

Note: Remove lube pump if you have one. See page 30.



15. Inspect output side gear o-rings for nicks and cuts. Replace if necessary.



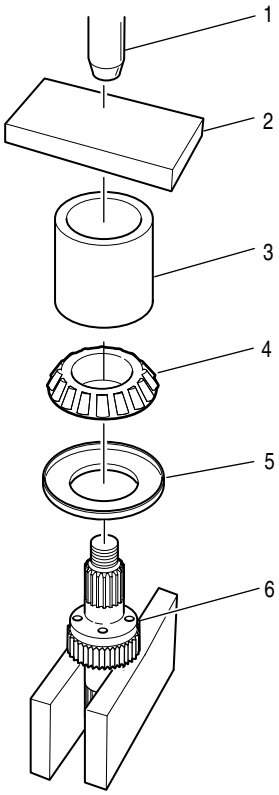
1—Press
2—Bearing
3—Oil retainer
4—Input shaft

16. Install new bearing cup.
17. Remove input shaft bearing cone and oil retainer, if necessary.
18. Press new oil retainer on input shaft.

⚠ CAUTION

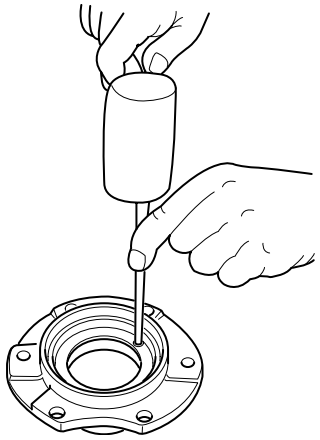
It is not recommended to reuse the oil retainer due to possible damage that may occur while removing the input shaft bearing cone. While pressing on new oil retainer, make sure not to over press, and/or press with the retainer at an angle. If the retainer is bent or distorted it may rub on the input cage or not seal properly to the v-ring.

19. Press input bearing cone on input shaft.

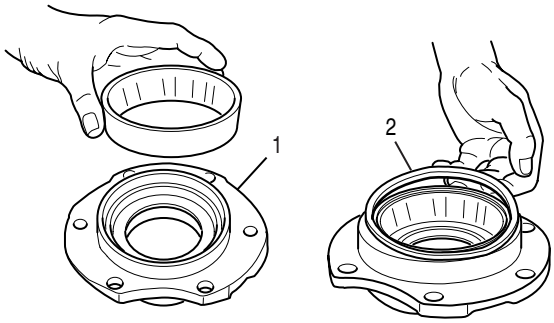


1 - Press
2 - Plate
3 - Drive Sleeve
4 - Input shaft bearing cone
5 - Oil retainer
6 - Input shaft

20. If input shaft bearing cup needs replacement, use either of the following recommended practices:
    - Weld a bead around the cup, when the weld cools the cup will fall out.
    - Drill a 1/4 size hole through the bearing cover to the back side of the cup and use a punch to remove the bearing cup.

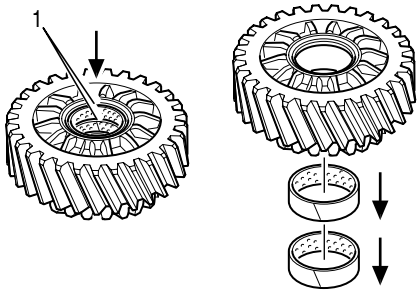


21. Press bearing cup in input bearing cover.
22. Install new oil v-ring on input bearing cage cover.



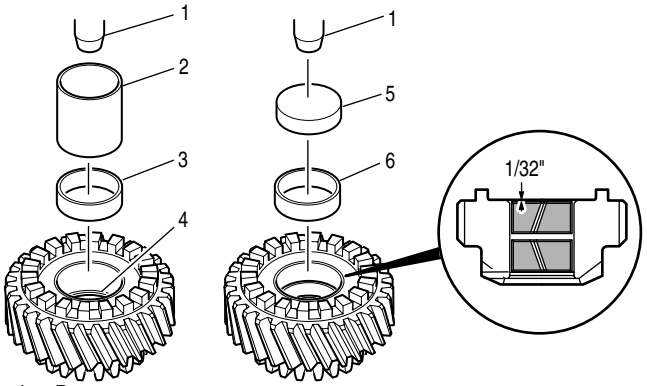
1—Bearing cup (press)
2—V-ring

23. If bushing removal is needed, the bushings must exit from the thrust washer side of the helical gear.



1—Tap out bronze bushings

24. Install bronze bushing in helical side gear. **Bushings must be installed from thrust washer side of gear.** See illustration for dimensional tolerances.



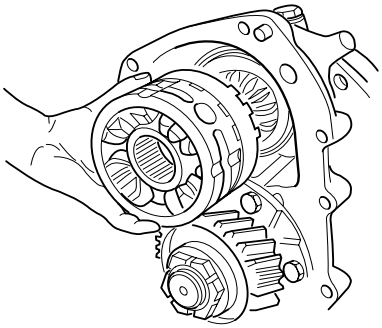
1—Press
2—Sleeve
3—1st bronze bushing (press to shoulder)
4—Shoulder
5—Sleeve
6—Second bronze bushing (recess 1/32”)

Lube Pump Removal
Assemblies Built Before June 2008

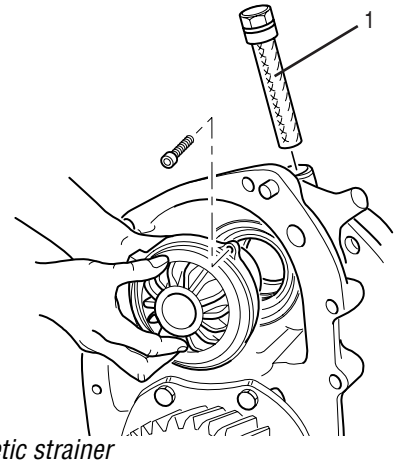
1. Remove inter-axle differential (IAD) and pump collar.

   TIP: The output shaft side gear and pump will be removed as an assembly. The lube pump assembly is located on the back side of the output shaft side gear, between the output shaft side gear and bearing cone.

Note: If the IAD assembly is to be reused, install in same direction as removed.



2. Remove the three pump retaining screws and remove the pump and output shaft side gear as an assembly.



1—Magnetic strainer

3. Inspect the lube pump if metal particles are found in axle assembly.
4. Remove the magnetic strainer from the carrier and inspect for wear material in the same manner as the drain plug. Wash the magnetic strainer in solvent and blow dry with compressed air to remove oil and metal particles.

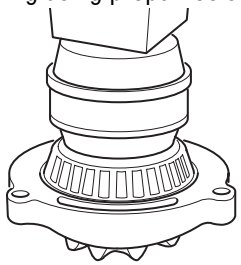
Note: The pump assembly must turn freely by hand. The pump is non-serviceable and must be replaced as a complete assembly.

Install Lube Pump Assemblies
Assemblies Built Before June 2008

1. Install lube pump assembly onto output side gear.

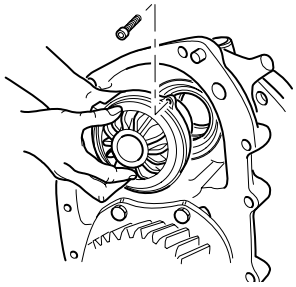
Note: The lube pump assembly is a slip-fit on the output shaft side gear, behind the press fit of the output shaft side gear bearing. The output shaft side gear bearing cone positions the pump assembly into the carrier.

2. Install bearing cone on output side gear.
3. Press bearing using proper tools until fully seated.



4. Reinstall output side gear pump and bearing assembly into carrier.
5. Tighten lube pump retaining screws to 17-21 lbs. ft. (23-38 N•m).

   TIP: The lube pump assembly is orientated in such a way that the three mounting/locating tabs will only line up one way.



Note: The lube pump is driven off the IAD assembly through a drive coupling. The drive coupling has drive tangs to both the IAD assembly and the lube pump. The IAD has notches that will accept the drive coupling on either face.

6. Install pump drive coupling.

Note: If reusing the IAD assembly, install in same direction as removed.

7. Reinstall IAD.

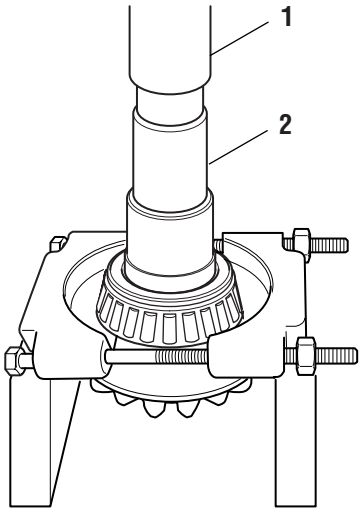
⚠ CAUTION

Exercise care to direct compressed air into a safe area. Wear safety glasses.

Lube Pump Removal: Assemblies Built After June 15, 2008

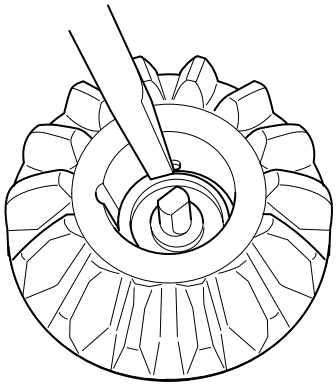
For output side gear and/or pump replacement, follow the procedure below.

1. Remove the output side gear bearing cone, if required.

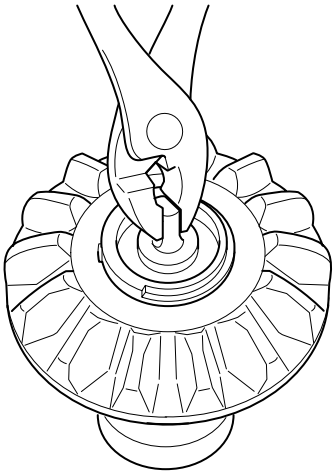


1 - Press
2 - Press Tool

2. Remove pump locking dowel pin from the hole in the output side gear hub.



3. Remove pump from the output side gear.



Lube Pump Installation: Assemblies Built After June 2008

Use these instructions with the carrier assembly in or out of the vehicle.

If the unit does not have a pump, go to the Power Divider Assembly section.

Note: Keep work area clean. Dirt is an abrasive and will cause premature wear of the otherwise serviceable parts.

Note: For non-pump models, see output side gear seal manifold installation.

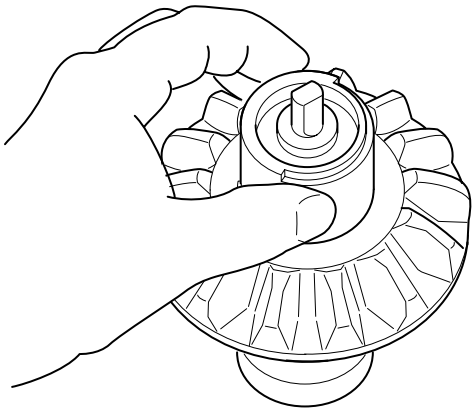
Note: Only service the power divider if the differential carrier is secured in a stand or while the axle is still attached to the housing.

CAUTION:

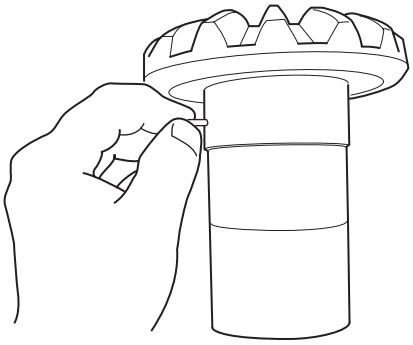
⚠ CAUTION

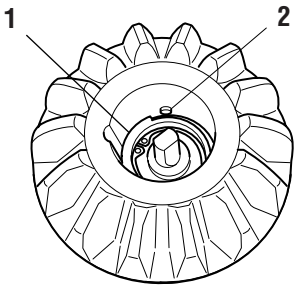
CAUTION: During installation of power divider cover, the inter-axle differential (IAD), input shaft assembly or IAD shift system parts may fall from the carrier if not careful. Use caution to prevent injury or damage.

1. Install the pump into the output side gear so that the pump shaft is facing toward the teeth end of the side gear.



2. Install the pump locking dowel pin into the hole in the output side gear hub. Make sure the pin is lined up with the machined slot in the pump body.





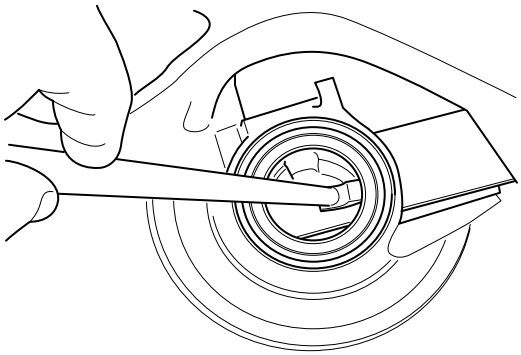
1 - Machined Slot
2 - Pin

Lube Manifold Removal

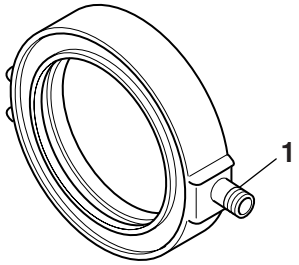
1. Disconnect the hose from the lube manifold.
2. Remove the manifold assembly by prying it out around the inner diameter.

⚠ IMPORTANT

IMPORTANT: Once removed, the seal manifold assembly cannot be reused. This component should always be replaced with new. Use the same removal procedure for the output side gear seal removal on the non-pump models.



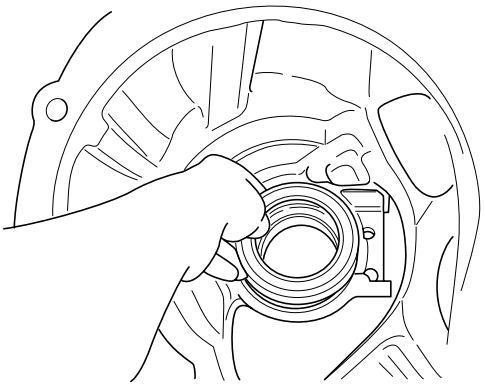
Note: Seals are not sold separately from the manifold.

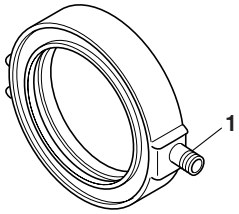


1 - Barbed Nipple

Manifold Installation

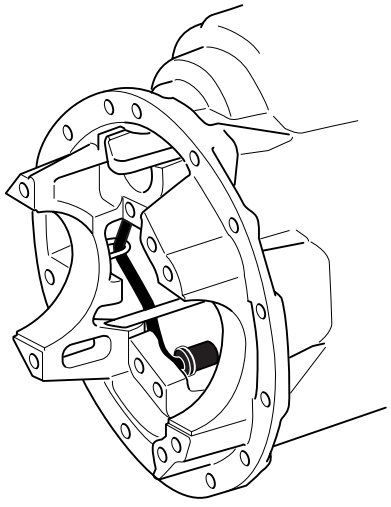
1. Install the manifold assembly into the output side gear bore in the carrier. Make sure the barbed nipple is lined up with the opening in the carrier casting.





1 - Barbed Nipple

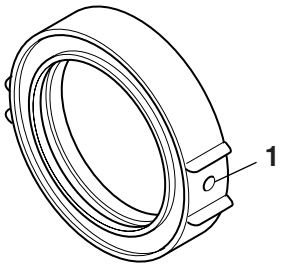
2. Install the hose clamp on the hose, push the hose onto the barbed fitting and slide the clamp over the barbed nipple.
3. Route the suction end of the hose through the holes in the carrier casting to the bottom of the carrier.



4. Fully press the manifold assembly into position.

Note: Use care when pressing the manifold assembly to avoid damaging the seals and barbed nipple. Do not over-press plastic.

Note: For non-pump manifold installation, it is important to line up the oil inlet path hole in the manifold with the oil path opening in the carrier manifold casting.



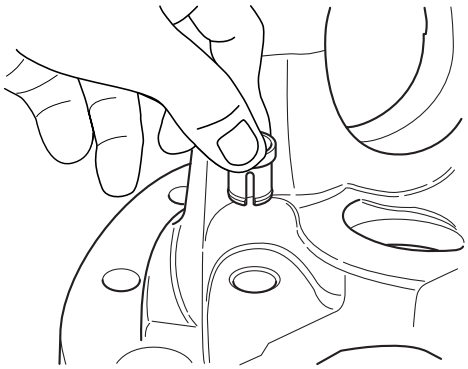
1 - Manifold Oil Inlet Hole

If the unit does not have a pump, go to the Power Divider Assembly section.

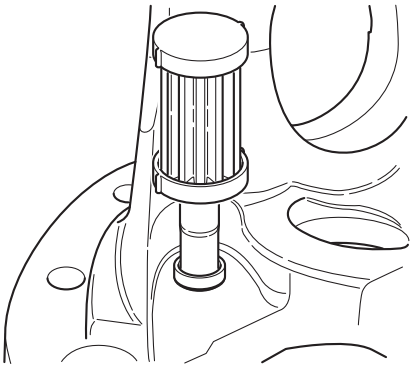
If the unit contains a pump, go to the Pump Assembly section.

Hose/ Filter Assembly

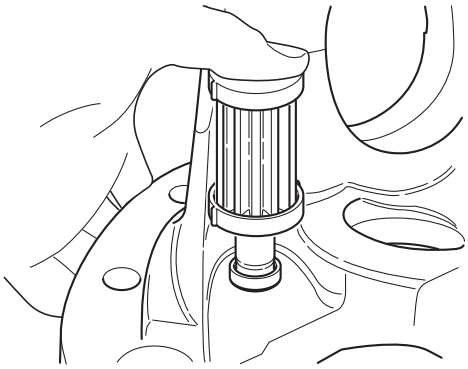
1. Look to see that the hose guide collar is installed and not damaged. If damaged or not present replace with new



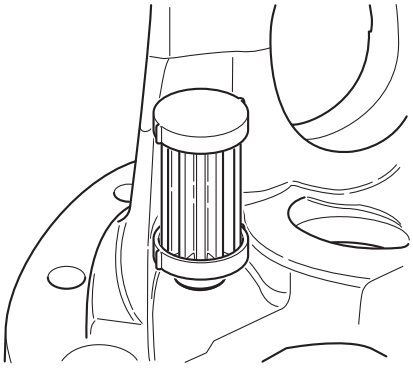
2. Now with the collar installed, push the hose through the back side of the collar and install the filter to the end of the hose.



3. Next, push the filter and hose down into the collar so that the filter is fully seated. Because of the increased diameter of the hose after the filter is installed,the hose should fit snugly in the collar



4. Fully seated position. Know hose should be showing and filter will contact the collar.



Install Power Divider to Carrier Assembly

Assemblies built AFTER 11/02/98 (In Vehicle)

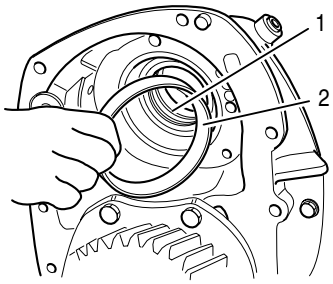
Note: See page 34 for out of vehicle.

Note: Parts inspection and cleaning procedures are important and should be adhered to. Cleanliness in your work area is important as dirt is an abrasive and will cause premature wear of the otherwise serviceable parts.

⚠ CAUTION

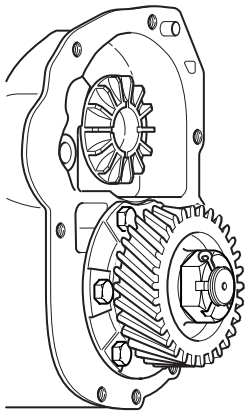
During installation of power divider components, the inter-axle differential, input shaft assembly or IAD shift system parts may fall from the carrier if not careful. Use caution to prevent injury or damage.

1. Make sure dowel pins are installed in carrier.
2. Install output side gear bearing cup, if removed. Press bearing cup in carrier. Use a press and an appropriate sleeve. Make certain bearing cup is evenly and firmly seated. If a press is not available, use a sleeve or a bearing driver tool and a hammer to install the cup.

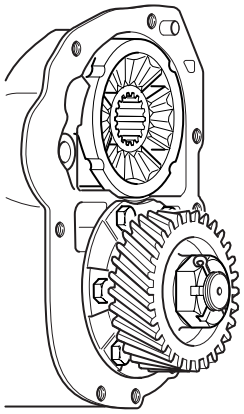


1—Lubricate o-rings
2—Bearing cup

3. Lubricate o-rings.
4. Install the output side gear, if removed.

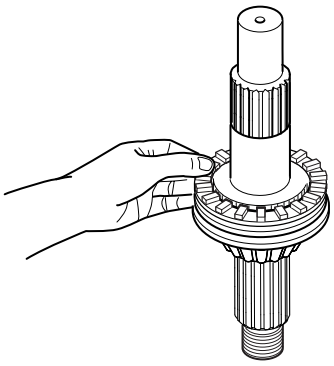


5. Install the IAD assembly to the output side gear. If reusing the IAD assembly, install in the same direction as removed.

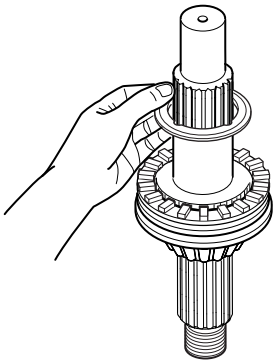


Note: For lube pump models, see page 30.

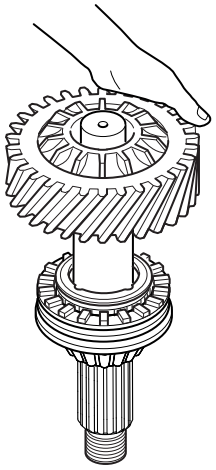
6. Out of the vehicle—on a bench, install lockout sliding clutch onto the input shaft.



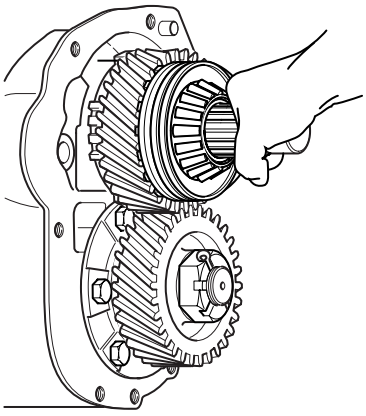
7. Install thrust washer.



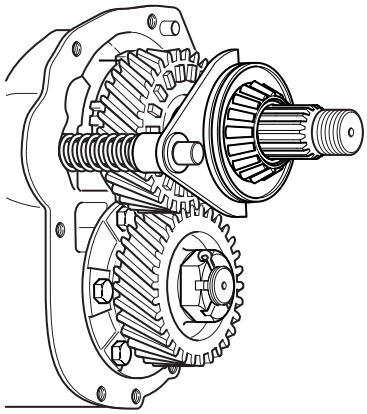
8. Install helical side gear and snap ring.



9. Install **input shaft drive assembly** into the carrier.



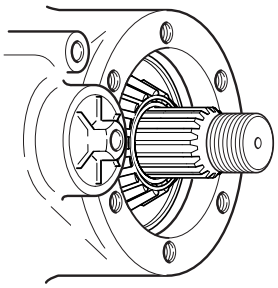
10. Install shift fork, compression spring and shift rod.



⚠ CAUTION

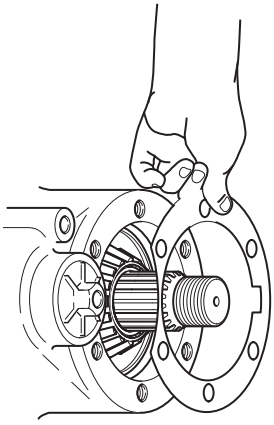
During installation of power divider components, a part may fall from the carrier. Use caution to prevent injury or damage.

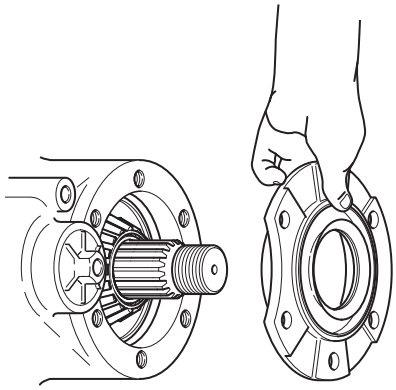
11. Install plastic trough in power divider cover.
12. Install power divider cover to carrier. Use Spicer approved RTV compound on the carrier mating surface. Torque capscrews to 114–140 lbs. ft. (155–190 N•m).



Note: Gasket compound will harden in 20 minutes. Install power divider quickly as possible to avoid future leaks.

13. Install input cage shim and input cage assembly.





14. Install input cage capscrews and tighten until snug.
15. Measure and adjust input shaft end-play, see page 40.
16. Torque input cage capscrews to 114–140 lbs. ft. (155–190 N•m).
17. Install NEW input seal, see page 72.
18. Reinstall input yoke.

Disassemble, Assemble, and Overhaul Power Divider

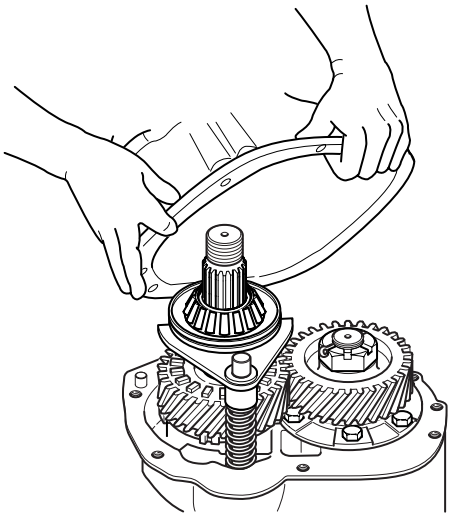
Assemblies built AFTER 11/02/98 – Out of Vehicle
The power divider cover comes off as a unit followed by the input shaft and then the helical side gear.

The power divider can be replaced with the axle assembly both in or out of the chassis and with the differential carrier assembled to the axle housing.

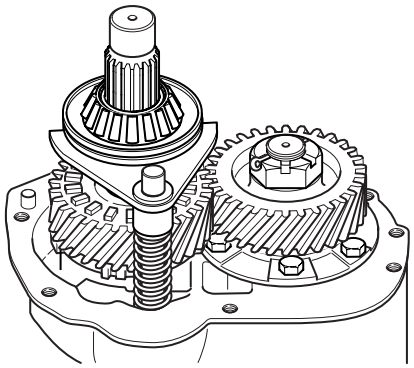
⚠ CAUTION

During removal of power divider cover, the inter-axle differential (IAD), input shaft assembly or IAD shift system parts may fall from the carrier if not careful. Use caution to prevent injury or damage.

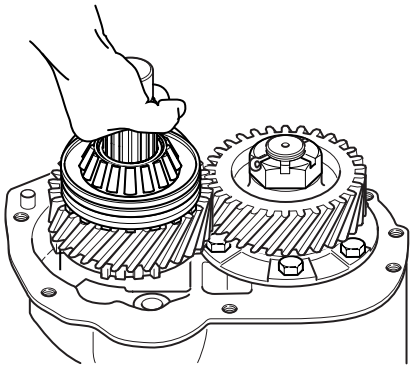
1. Disconnect the main driveline.
2. Disconnect the lockout air line.
3. Remove input yoke.
4. Remove input seal.
5. Position a drain pan under the power divider unit.
6. Remove PDU capscrews.
7. Remove power divider cover.



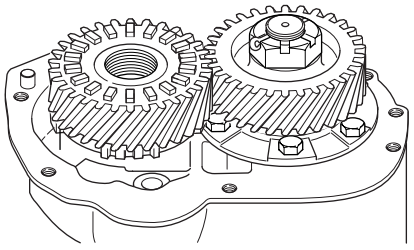
8. Remove shift fork, compression spring and shift rod.



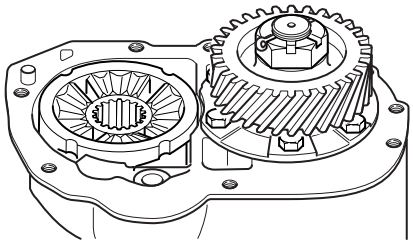
9. Remove **input shaft and helical thrust washer** from the carrier.



10. Remove helical side gear.

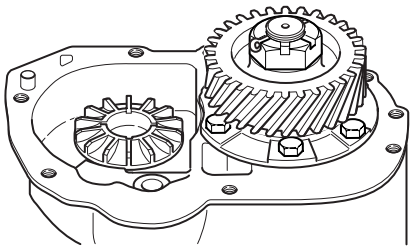


11. Remove the IAD assembly from the output side gear.

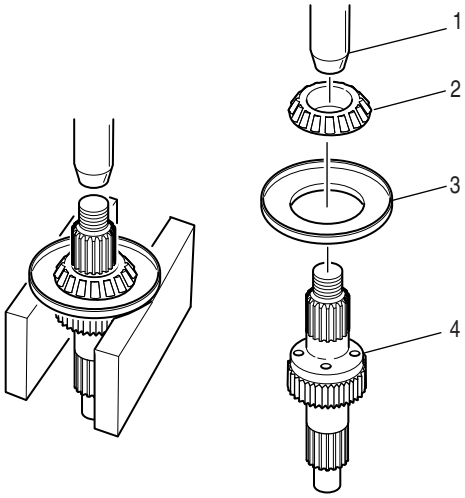


12. Remove the output side gear.

Note: Remove lube pump if you have one.



13. Inspect output side gear o-rings for nicks and cuts. Replace if necessary.
14. Install new bearing cup.
15. Remove input shaft bearing cone and oil retainer, if necessary.



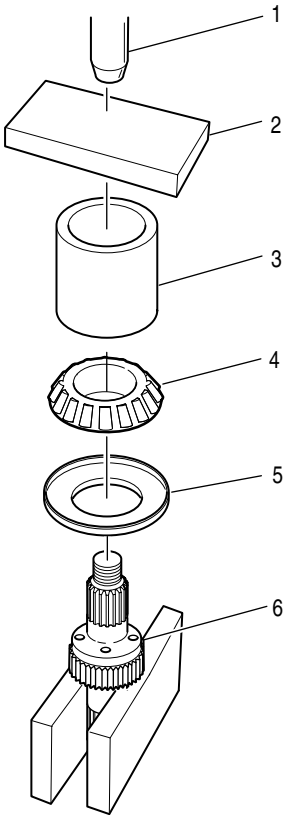
1—Press
2—Bearing
3—Oil retainer
4—Input shaft

16. Press new oil retainer on input shaft.

⚠ CAUTION

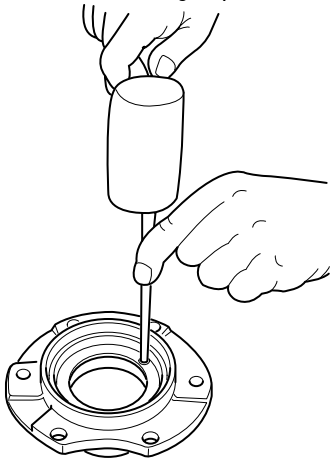
It is not recommended to reuse the oil retainer due to possible damage that may occur while removing the input shaft bearing cone. While pressing on new oil retainer, make sure not to over press, and/or press with the retainer at an angle. If the retainer is bent or distorted it may rub on the input cage or not seal properly to the v-ring.

17. Press input bearing cone on input shaft.

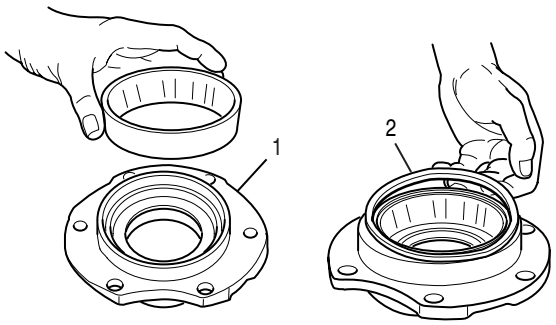


1—Press
2—Plate
3—Drive sleeve
4—Input shaft bearing cone
5—Oil retainer
6—Input shaft

18. If input shaft bearing cup needs replacement, use either of the following recommended practices:
    - Weld a bead around the cup, when the weld cools the cup will fall out.
    - Drill a 1/4 size hole through the bearing cover to the back side of the cup and use a punch to remove the bearing cup.

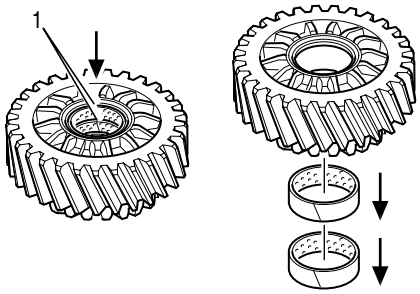


19. Press bearing cup in input bearing cover.
20. Install new oil v-ring on input bearing cage cover.



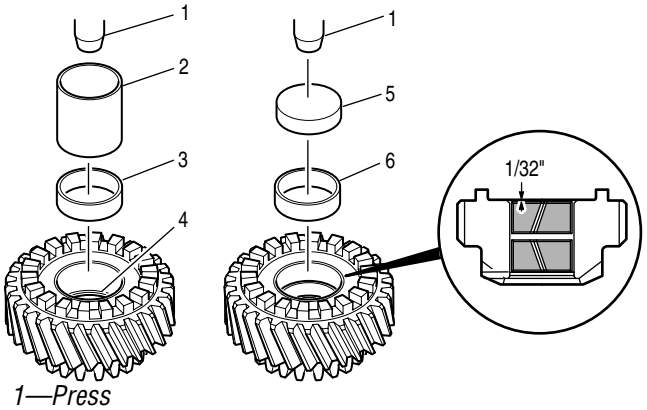
1—Bearing cup (press)
2—V-ring

21. If bushing removal is needed, the bushings must exit from the thrust washer side of the helical gear.



1—Tap out bronze bushings

22. Install bronze bushing in helical side gear. **Bushings must be installed from thrust washer side of gear.** See illustration for dimensional tolerances.



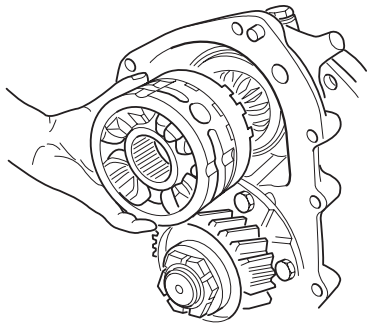
1—Press
2—Sleeve
3—1st bronze bushing (press to shoulder)
4—Shoulder
5—Sleeve
6—Second bronze bushing (recess 1/32”)

Lube Pump Removal: Assemblies Built Before June 15, 2008

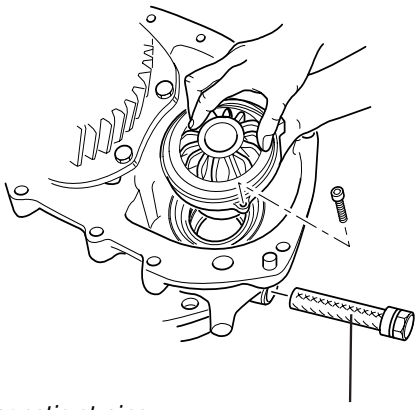
1. Remove inter-axle differential (IAD) and pump collar.

   TIP: The output shaft side gear and pump will be removed as an assembly. The lube pump assembly is located on the back side of the output shaft side gear, between the output shaft side gear and bearing cone.

Note: If the IAD assembly is to be reused, install in same direction removed.



2. Remove the three pump retaining screws and remove the pump and output shaft side gear as an assembly.



1—Magnetic strainer

3. Inspect the lube pump if metal particles are found in axle assembly.
4. Remove the magnetic strainer from the carrier and inspect for wear material in the same manner as the drain plug. Wash the magnetic strainer in solvent and blow dry with compressed air to remove oil and metal particles.

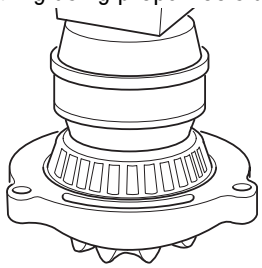
Note: The pump assembly must turn freely by hand. The pump is non-serviceable and must be replaced as a complete assembly.

Lube Pump Installation: Assemblies Built Before June 15, 2008

1. Install lube pump assembly onto output side gear.

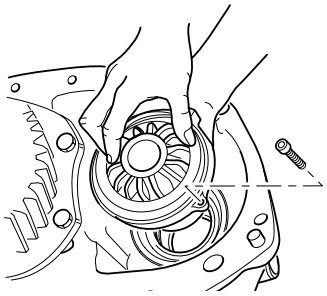
Note: The lube pump assembly is a slip-fit on the output shaft side gear, behind the press fit of the output shaft side gear bearing. The output shaft side gear bearing cone positions the pump assembly into the carrier.

2. Install bearing cone on output side gear.
3. Press bearing using proper tools until fully seated.



4. Reinstall output side gear pump and bearing assembly into carrier.
5. Tighten lube pump retaining screws to 17-21 lbs. ft. (23-38 N•m).

   TIP: The lube pump assembly is orientated in such a way that the three mounting/locating tabs will only line up one way.



Note: The lube pump is driven off the IAD assembly through a drive coupling. The drive coupling has drive tangs to both the IAD assembly and the lube pump. The IAD has notches that will accept the drive coupling on either face.

6. Install pump drive coupling.

Note: If reusing the IAD assembly, install in same direction as removed.

7. Reinstall IAD.

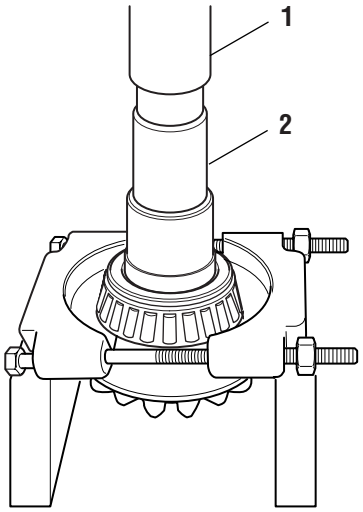
⚠ CAUTION

Exercise care to direct compressed air into a safe area. Wear safety glasses.

Lube Pump Removal: Assemblies Built After June 2008

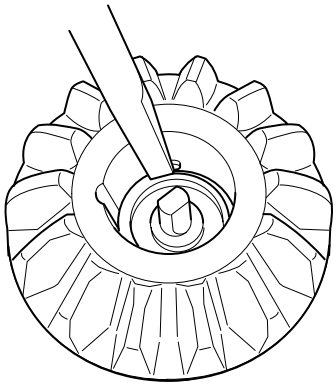
For output side gear and/or pump replacement, follow the procedure below.

1. Remove the output side gear bearing cone, if required.

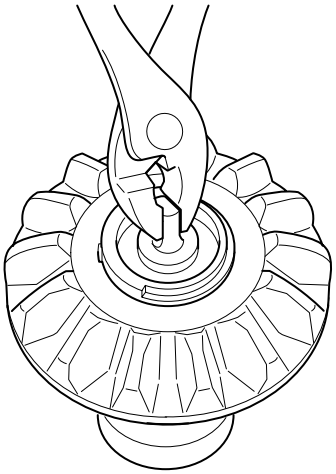


1 - Press
2 - Press Tool

2. Remove pump locking dowel pin from the hole in the output side gear hub.



3. Remove pump from the output side gear.



Lube Pump Installation: Assemblies Built After June 2008

Use these instructions with the carrier assembly in or out of the vehicle.

If the unit does not have a pump, go to the Power Divider Assembly section.

Note: Keep work area clean. Dirt is an abrasive and will cause premature wear of the otherwise serviceable parts.

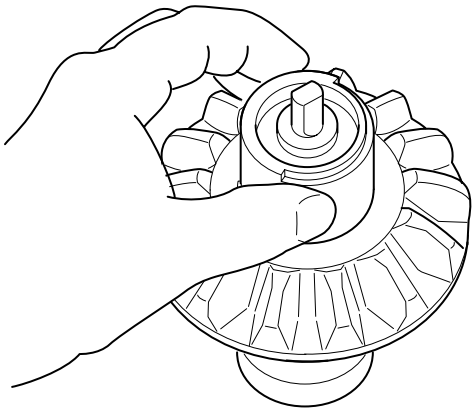
Note: For non-pump models, see page 17 for output side gear seal manifold installation.

Note: Only service the power divider if the differential carrier is secured in a stand or while the axle is still attached to the housing.

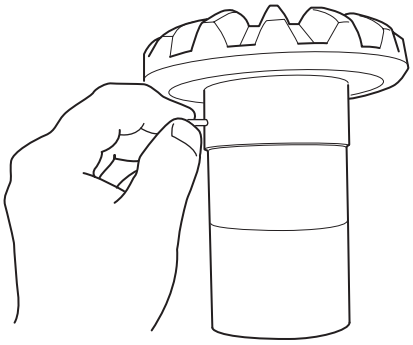
⚠ CAUTION

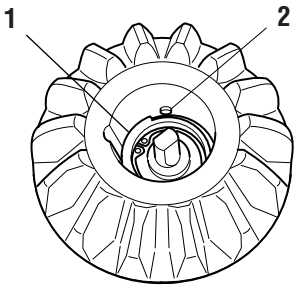
During installation of power divider cover, the inter-axle differential (IAD), input shaft assembly or IAD shift system parts may fall from the carrier if not careful. Use caution to prevent injury or damage.

1. Install the pump into the output side gear so that the pump shaft is facing toward the teeth end of the side gear.



2. Install the pump locking dowel pin into the hole in the output side gear hub. Make sure the pin is lined up with the machined slot in the pump body.





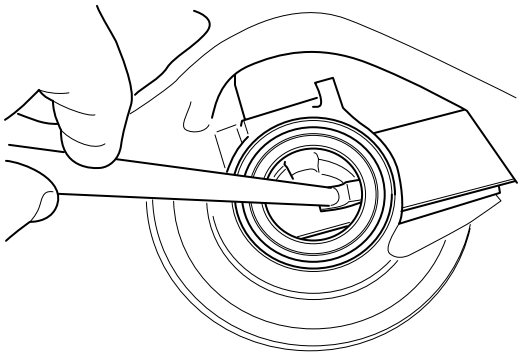
1 - Machined Slot
2 - Pin

Lube Manifold Removal

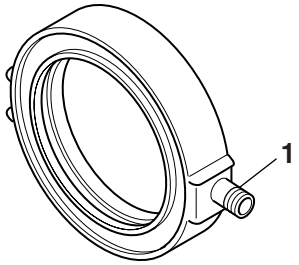
1. Disconnect the hose from the lube manifold.
2. Remove the manifold assembly by prying it out around the inner diameter.

⚠ IMPORTANT

Once removed, the seal manifold assembly cannot be reused. This component should always be replaced with new. Use the same removal procedure for the output side gear seal removal on the non-pump models.



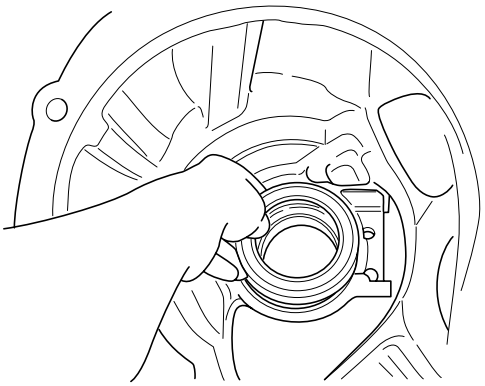
Note: Seals are not sold separately from the manifold.

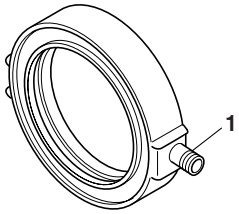


1 - Barbed Nipple

Manifold Installation

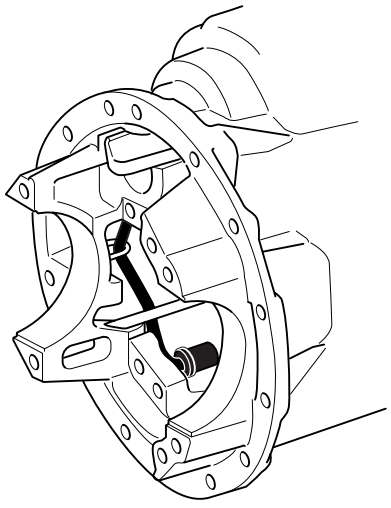
1. Install the manifold assembly into the output side gear bore in the carrier. Make sure the barbed nipple is lined up with the opening in the carrier casting.





1 - Barbed Nipple

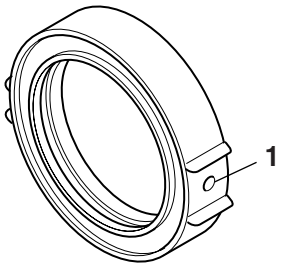
2. Install the hose clamp on the hose, push the hose onto the barbed fitting and slide the clamp over the barbed nipple.
3. Route the suction end of the hose through the holes in the carrier casting to the bottom of the carrier.



4. Fully press the manifold assembly into position.

Note: Use care when pressing the manifold assembly to avoid damaging the seals and barbed nipple. Do not over-press plastic.

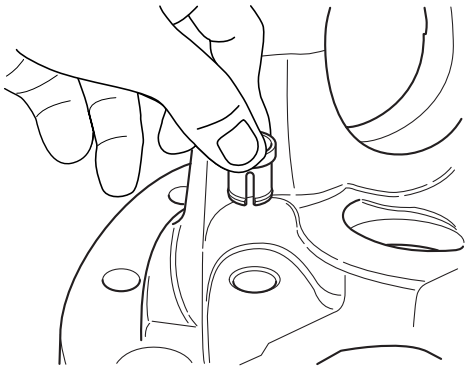
Note: For non-pump manifold installation, it is important to line up the oil inlet path hole in the manifold with the oil path opening in the carrier manifold casting.



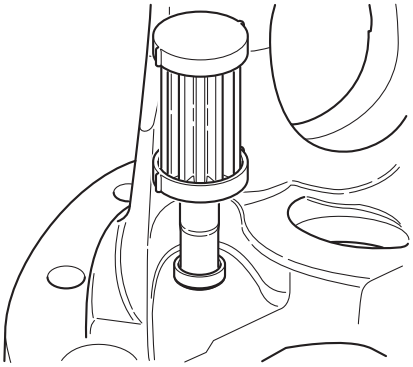
1 - Manifold Oil Inlet Hole

Hose/ Filter Assembly

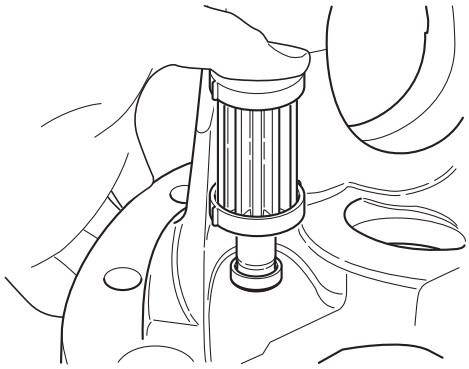
1. Look to see that the hose guide collar is installed and not damaged. If damaged or not present replace with new



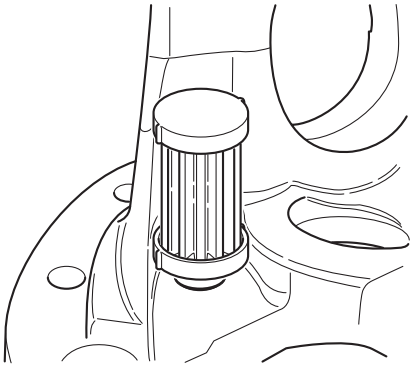
2. Now with the collar installed, push the hose through the back side of the collar and install the filter to the end of the hose.



3. Next, push the filter and hose down into the collar so that the filter is fully seated. Because of the increased diameter of the hose after the filter is installed,the hose should fit snugly in the collar



4. Fully seated position. Know hose should be showing and filter will contact the collar.



Install Power Divider to Carrier Assembly

Assemblies built AFTER 11/02/98 (Out of Vehicle)

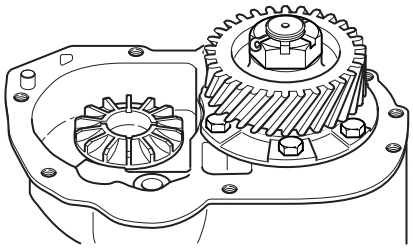
Note: Parts inspection and cleaning procedures are important and should be adhered to. Cleanliness in your work area is important as dirt is an abrasive and will cause premature wear of the otherwise serviceable parts.

Note: It is assumed that the different carrier is secured in a stand.

⚠ CAUTION

During installation of power divider components, parts may fall from the carrier if not careful. Use caution to prevent injury or damage.

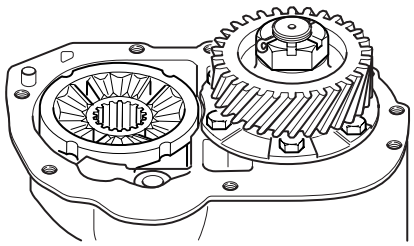
1. Make sure dowel pins are installed in carrier.
2. Output side gear bearing cup. If removed, press bearing cup in carrier. Use a press and an appropriate sleeve. Make certain bearing cup is evenly and firmly seated. If a press is not available, use a sleeve or a bearing driver tool and a hammer to install the cup.
3. Lubricate o-rings.
4. Install the output side gear using one of the following instructions (non-pump models or lube pump models).



Non-pump Models

a. Install output side gear.

b. Install the IAD assembly to the output side gear. If reusing the IAD assembly, install the same direction as removed.

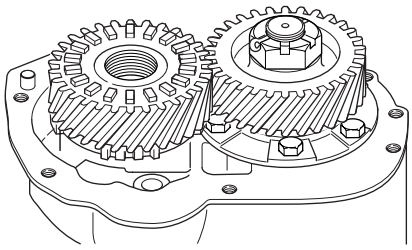


Lube Pump Models

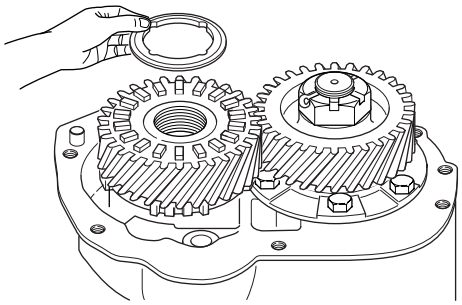
a. Install output side gear/pump assembly into carrier. The lube pump mounting holes are oriented in such a way that it can be installed only in one position.

b. Lube pump coupling—Line up the drive couplings tangs with the pump and IAD notches. The spacing of the tangs are the same, one side to the other. If reusing the IAD assembly, install the same direction as it was removed.

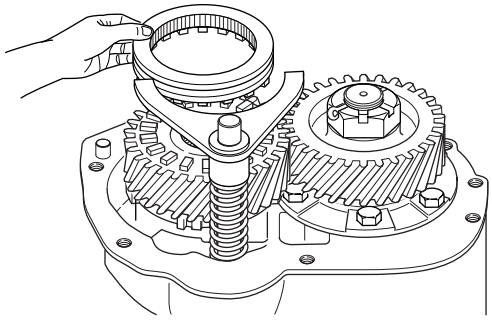
5. Install helical side gear.



6. Install thrust washer.

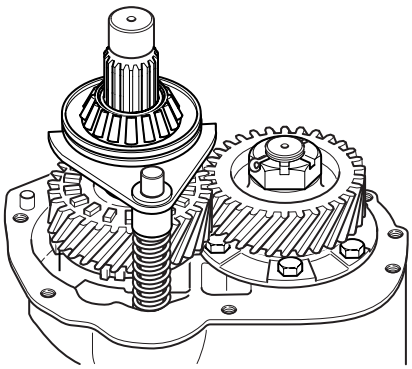


7. Install compression spring, shift fork, push rod and lockout sliding clutch.



8. Install input shaft assembly.

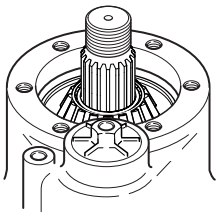
Note: The input shaft snap ring is not used in this buildup.



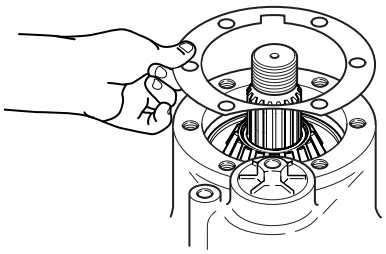
9. Install plastic oil trough in power divider cover.

10. Install power divider cover to carrier. Use Spicer approved RTV compound on the carrier mating surface. Torque capscrews to 114–140 lbs. ft. (155–190 N•m).

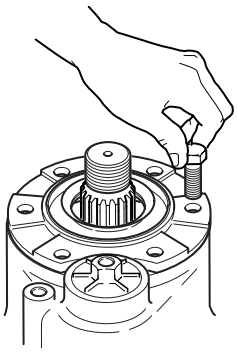
Note: Gasket compound will harden in 20 minutes. Install power divider as quickly as possible to avoid future leaks.



11. Install input cage shim and input cage assembly.



12. Install input cage capscrews and tighten until snug.



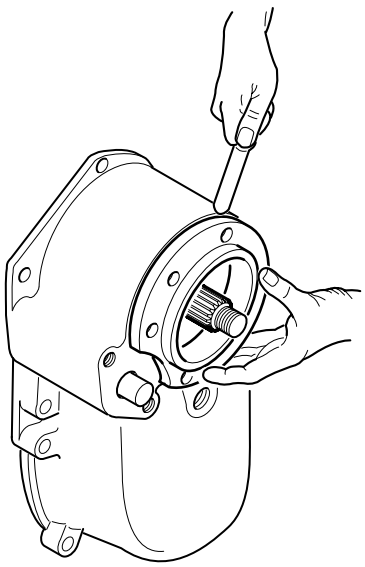
13. Measure and adjust input shaft end-play, see page 39.
14. Torque input cage capscrews to 114–140 lbs. ft. (155–190 N•m)
15. Install NEW input seal, see page 71.
16. Reinstall input yoke.

Measure and Adjust Input Shaft End-Play

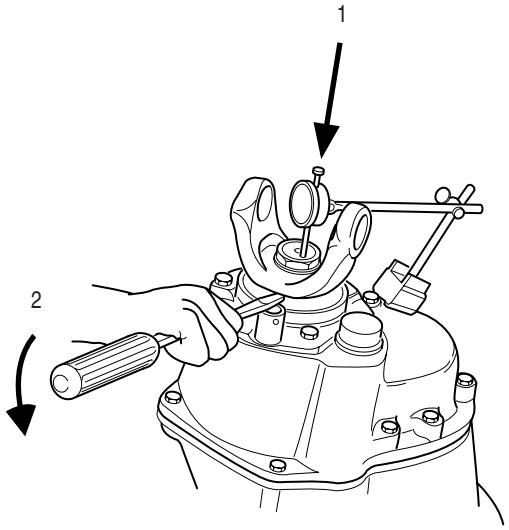
Note: After power divider overhaul and installation on carrier, check and adjust input shaft end-play.

The correct end-play when new parts are used in overhaul is .0.003” to 0.007”, with reused parts the maximum is 0.014”.

1. Remove input shaft nut. Remove input bearing cover capscrews. Remove bearing cover (and shim pack if installed).
2. Reinstall bearing cover without shims. Hold in position with hand pressure and measure clearance between power divider cover and bearing cover, using a feeler gauge.



3. The bearing cover clearance measured in Step 2 plus 0.005” will equal shim pack thickness required for desired end-play (rebuild with new parts). Add 0.015” to shim pack for rebuild with used parts.
4. Install shim pack and bearing cover. Install capscrews. Torque screws to 114–140 lbs. ft. (155–190 N•m). Make sure shims are flat with no kinks or bends.



1—Push in and zero indicator, read and record
2—Pry down

5. Install yoke using installation tool and nut. Tighten nut snugly. Tap end of input shaft lightly to seat bearings.
6. Check input shaft end-play with dial indicator positioned at yoke end of input shaft. Move input shaft axially and measure end-play. If end-play is correct, seal shim pack with Spicer approved RTV compound to prevent lube leakage. Then torque input shaft nut.
7. If end-play is incorrect, change shim pack size as follows:

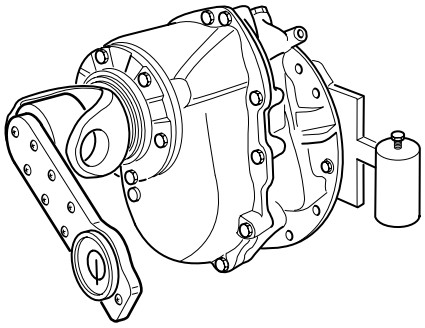
Add shims to increase end-play.

Desired end-play (New Parts)	*0.003” to 0.007”*
Measured end-play (Step 6)	*0.001” – 0.001”*
Add shims to provide desired end-play	*0.002” to 0.006”*

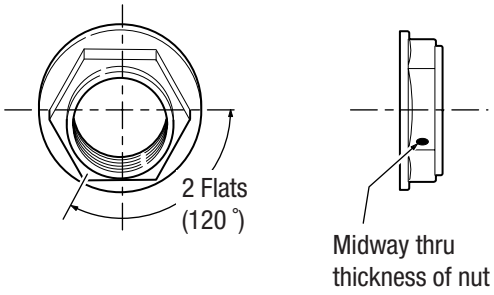
Remove shim to decreased end-play.

Measured end-play (Step 6)	*0.015” – 0.015”*
Desired end-play (New Parts)	*0.003” to 0.007”*
Remove shims to provide desired end-play	*0.012” to 0.008”*

8. To add or remove shims, remove input shaft nut and yoke. Remove capscrews, lock washers and bearing cover. Add or remove shims as required.
9. Install bearing cover and capscrews. Seal shim pack with Spicer approved RTV compound to prevent lube leakage then torque input shaft capscrews 150–165 lbs. ft. (204–224 N•m).
10. Install yoke.
11. Install yoke nut. One of the following options may be used.
    a. Install a new nut with the pre-applied thread adhesive compound. Tighten the nut to the specified torque 840–1020 lbs. ft. (1148–1383 N•m).



    b. If a new nut with pre-applied thread adhesive compound is unavailable, apply “Loctite 277” or “271” (available in .5 ml tube– P/N 129293) to the nut along two threads, for at least two flats (120°) of the nut midway through the thickness. Tighten the nut to the specified torque 840–1020 lbs. ft. (1148–1383 N•m).



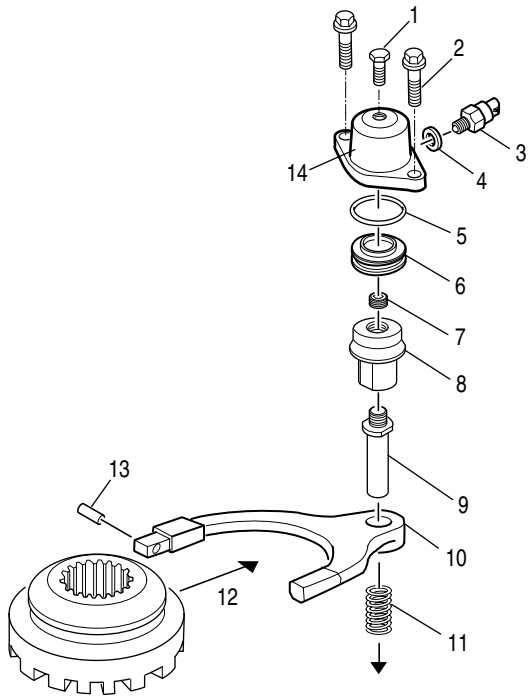
Note: Use of a torque multiplier is recommended.

If difficulty is experienced in achieving correct torque, torque the nut with the truck wheels on the ground and with the axle shaft installed.

⚠ IMPORTANT

Follow the instructions specified by the thread adhesive manufacture when applying thread adhesive compound.

Carrier Assembly - Parts Exploded View



1 — Piston engagement bolt
2 — Capscrew
3 — Switch
4 — Washer
5 — O-ring
6 — Piston
7 — Setscrew
8 — Piston driver
9 — Pushrod
10 — Clutch fork
11 — Spring
12 — Sliding clutch
13 — Pin
14 — Piston cover

Disassemble Carrier Assembly (All Forward and Rear Axles)

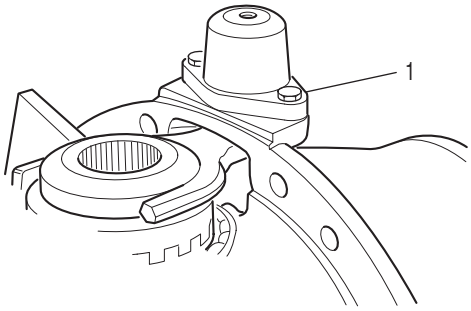
Note: For models having the wheel differential lock option or a carrier thrust bolt follow the steps below. These parts must be removed first before further removal of the wheel differential can take place.

Remove Wheel Differential – Models with Wheel Differential Lock

1. For ease of servicing, mount differential carrier in stand with differential lock facing up.

Note: To overhaul and reassemble the wheel differential, the shift fork and clutch assembly must be removed from carrier. See instructions below.

2. Remove shift cylinder mounting screws, then lift shift cylinder, piston and o-ring assembly off carrier and end of push rod.



1—Shift cylinder

3. To disassemble shift cylinder for inspection, first remove or back off actuator switch. The piston and o-ring assembly can be removed by inserting a pencil-size tool through the cylinder air port.

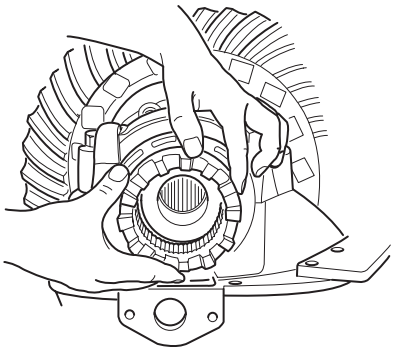
4. Grasp push rod end and pull it out of the shift fork, spring and carrier.

Note: When the push rod is disengaged from the shift fork, the fork and sliding curvic clutch assembly can be removed from carrier.

Note: Do not disassemble shift fork from the sliding curvic clutch unless parts replacement is necessary. To disassemble, use pin punch to remove spring pin from long leg of fork. The fork can now be disengaged from the clutch.

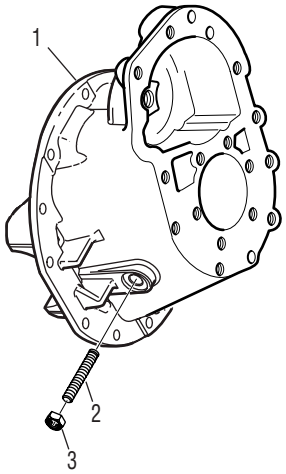
5. Remove the snap ring, then lift fixed curvic clutch off differential case hub spline. Further disassembly of carrier is the same for axles without differential lock.

Models with Ring Gear Thrust Bolt



Note: If the carrier model has a ring gear thrust bolt installed, it must be backed away from the ring gear before you can remove the wheel differential.

1. Back off thrust bolt jam nut.
2. Back out thrust bolt from the carrier until the end of the bolt is flush with the inside of the carrier casting. This will allow enough clearance between the ring gear and the carrier pilot web.

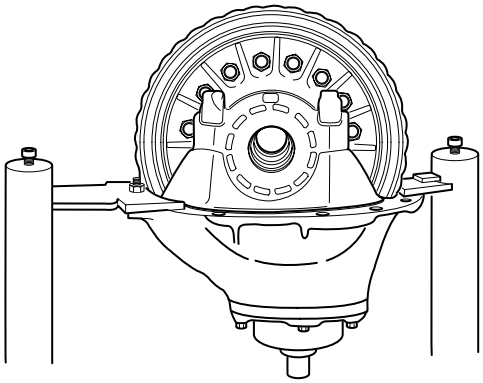


1—D-head carrier or front carrier
2—Thrust bolt
3—Thrust bolt jam nut

Remove Wheel Differential (All Standard Models)

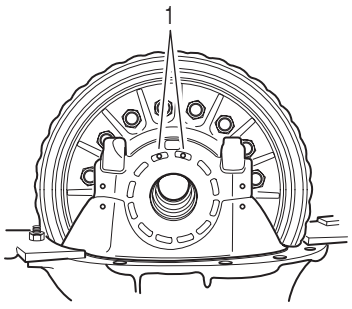
Note: Omit this step if the gear set is to be replaced. If gear set is to be reused, check tooth contact pattern and ring gear backlash before disassembling differential carrier. When checking backlash, a yoke or helical gear must be installed and torqued to get an accurate reading. Best results are obtained when established wear patterns are maintained in used gearing.

1. Mount differential carrier in repair stand.



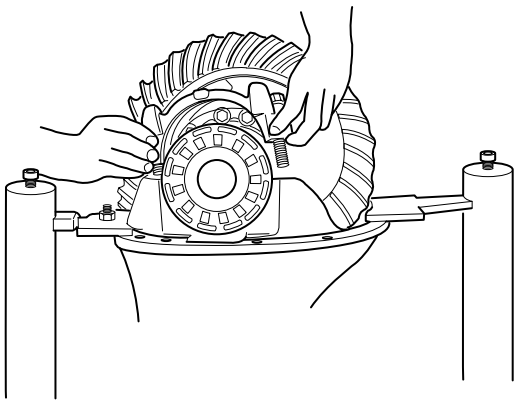
Note: For easier disassembly, loosen but do not remove pinion (self-locking) nut. Forward axle pinion is equipped with slotted nut, remove roll pin with a pin punch then loosen nut.

2. If reusing gear set, also punch mark bearing adjusters for reference during assembly.

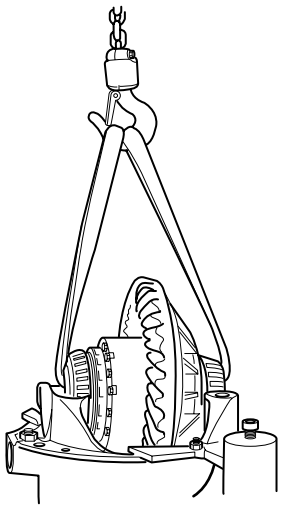


1—Punch marks

3. Remove capscrews, flat washers and bearing caps. Back off bearing adjusters and remove adjusters and bearing cups.

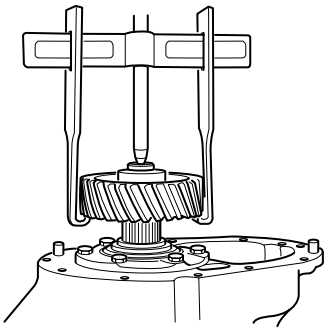


4. Using a chain hoist, lift ring gear and differential assembly out of carrier.



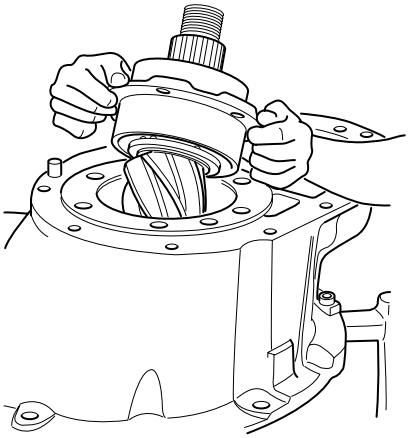
Remove Pinion Assembly

1. Remove pinion bearing cage capscrews. Remove pinion and cage assembly from carrier. Remove shim pack.



Note: For easier disassembly, loosen but do not remove pinion (self-locking) nut. Forward axle pinion is equipped with slotted nut, remove roll pin with a pin punch then loosen nut.

2. Remove pinion bearing cage capscrews. Remove pinion and cage assembly from carrier. Remove shim pack.

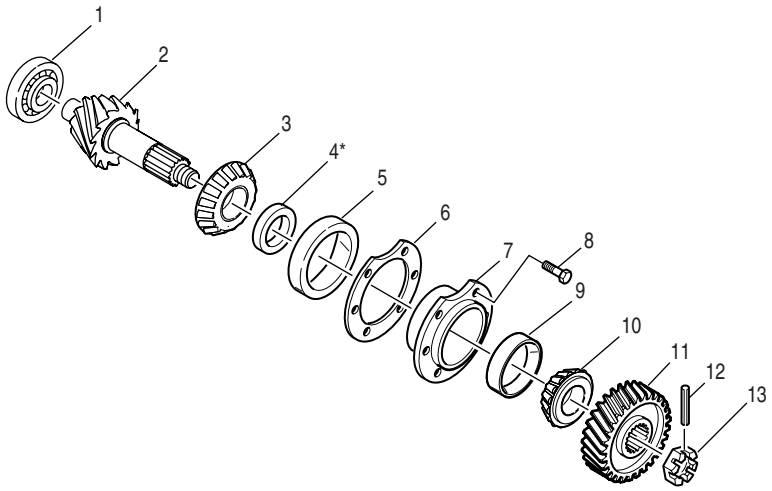


⚠ IMPORTANT

Do not allow pinion to drop on hard surface.

If gear set is to be reused, keep pinion bearing cage shim pack intact for use in reassembly. If the original shims cannot be reused, record the number and size of shims in the pack.

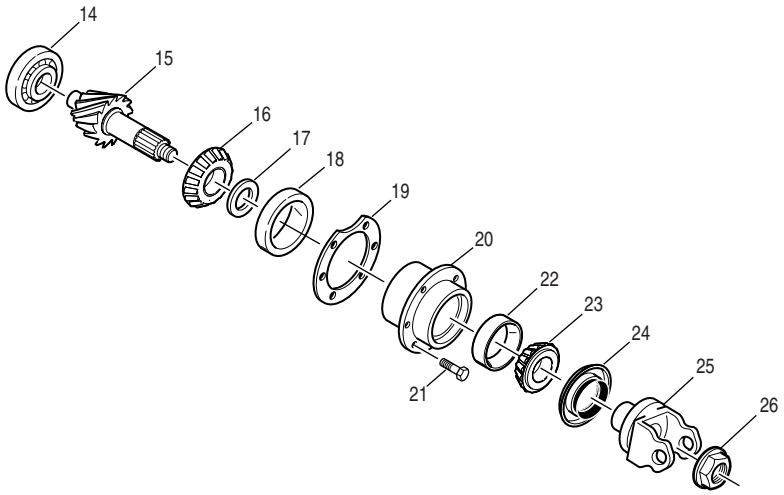
Front Axle Pinion Assembly - Parts Exploded View



1—Pinion pilot brg.
2—Pinion
3—Pinion brg. cone - inner
*4—Pinion brg. spacer**
5—Pinion brg. cup - inner
6—Shim
7—Pinion brg. cage
8—Capscrew
9—Pinion brg. cup - outer
10—Pinion brg. cone - outer
11—Pinion helical gear
12—Roll pin
13—Slotted pinion nut

** Before 3/01/95 two spacers were used instead of the one shown.*

Rear Axle Pinion Assembly - Parts Exploded View



14—Pinion pilot brg.
15—Pinion
16—Pinion brg. cone - inner
17—Pinion brg. spacer
18—Pinion brg. cup - inner
19—Shim
20—Pinion brg. cage
21—Capscrew
22—Pinion brg. cup - outer
23—Pinion brg. cone - outer
24—Oil seal
25—Yoke
26—Pinion nut

Disassemble and Overhaul Drive Pinion

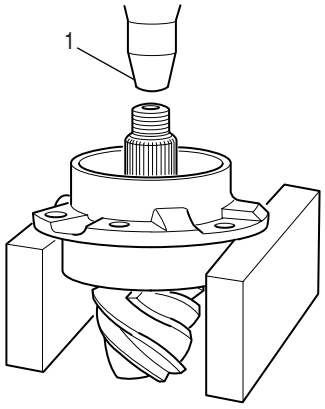
The following procedures cover both forward and rear differential drive carrier disassembly.

1. **Rear Axle Pinion Yoke:** Remove yoke.

⚠ CAUTION

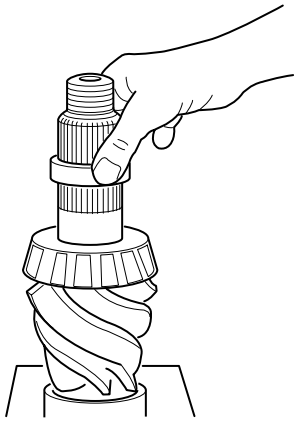
If pinion nut was not loosened during earlier disassembly, clamp assembly in vise jaws, use brass pads to prevent damage.

2. Loosen and remove pinion nut and flat washer. Remove yoke from pinion using an appropriate tool.
3. **Forward and Rear Axle Pinion Bearing Cage:** Press pinion out of bearing cage and bearing cone.

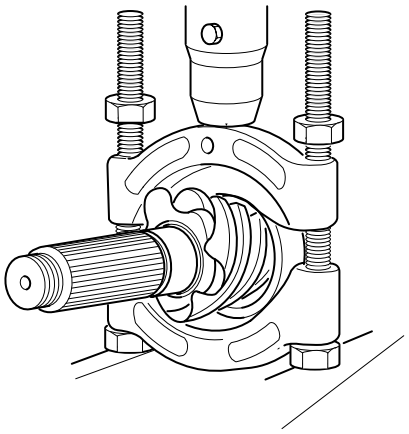


1 - Press ram

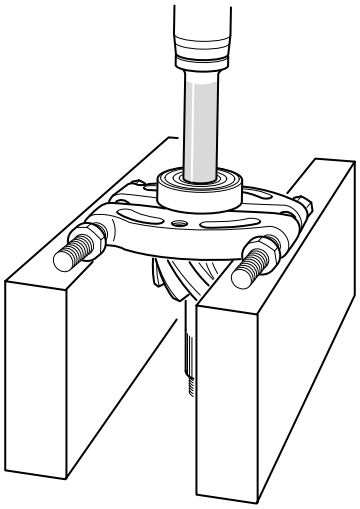
4. **Rear Axle Pinion Oil Seal and Outer Bearing Cone:** Remove oil seal and bearing cone from cage. Discard oil seal. Remove bearing cups with suitable puller.
5. Remove bearing spacer from pinion.



6. Remove pilot bearing from pinion using a split-type puller. Use two procedure steps to remove each bearing.
   a. Mount puller vertically to separate the bearing. This action will force puller halves under bearing and start moving bearing off pinion.

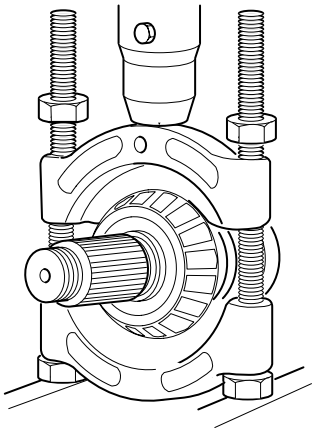


   b. Mount puller horizontally to press pinion out of bearing.

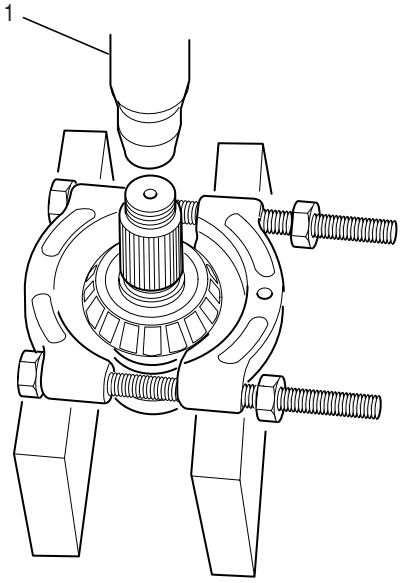


7. Remove inner bearing cone from pinion using a split-type puller. Use two procedure steps to remove each bearing.

   a. Mount puller vertically to separate the bearing. This action will force puller halves under bearing and start moving bearing off pinion.

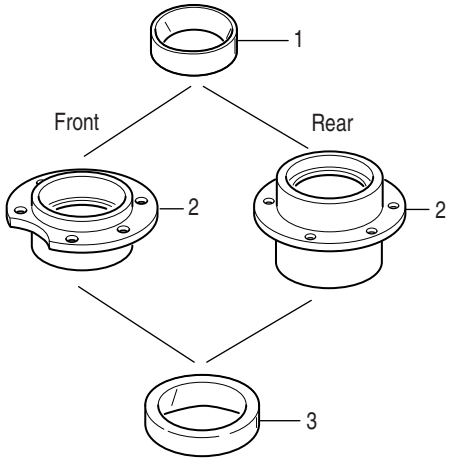


   b. Mount puller horizontally to press pinion out of bearing.



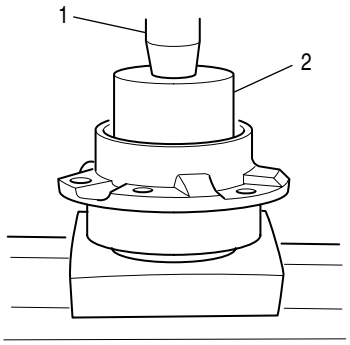
1 - Press

Replace Pinion Bearing Cage Cups



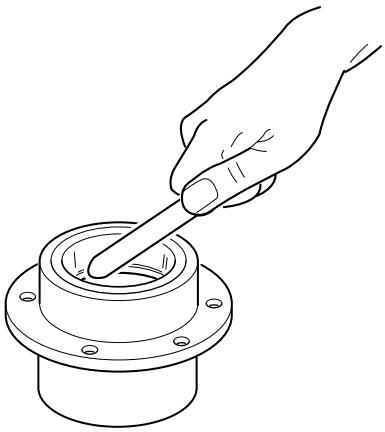
1 - Cup(outer)
2 - Bearing cage
3 - Cup (inner)

1. Remove cups.
2. Clean and inspect bearing cages for damage, nicks and burrs.



1 - Press ram
2 - Sleeve must apply pressure to back face of outer bearing cone

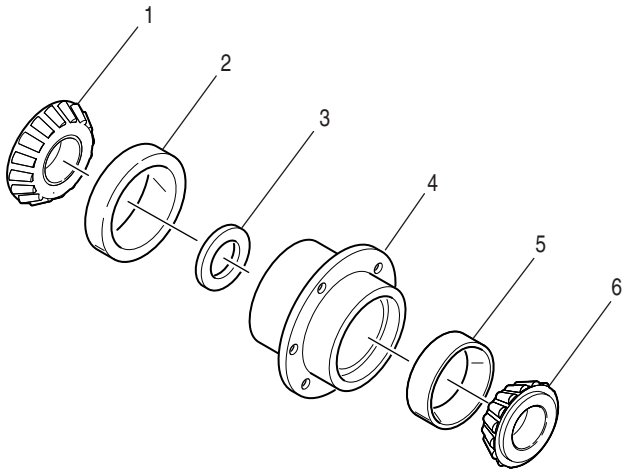
3. Install inner and outer pinion bearing cups. Use a press and an appropriate drive sleeve. Make certain bearing cup is evenly and firmly seated.
4. Seat cups securely to shoulder. Check clearance between cup and bearing cage. Must be less than .001”.



Adjust Pinion Bearing Preload

Trial Buildup

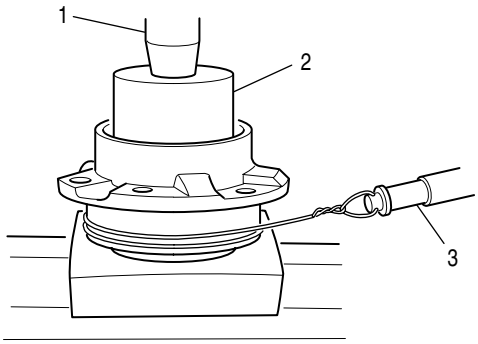
1. Assemble pinion bearing cage, bearings, spacer and spacer washer (without drive pinion or oil seal). Center bearing spacer between two bearing cones. Lubricate bearing cups and cones.



1 - Bearing
2 - Cup
3 - Spacer
4 - Cage
5 - Cup
6 - Bearing

Note: When new gear set or pinion bearings are used, select nominal size spacer from the specification chart. If original parts are used, use spacer removed during disassembly.

2. With the bearings well lubricated, place the assembly in the press. Position sleeve so that load is applied directly to the backface of the outer bearing cone.



1 - Press ram
2 - Sleeve must apply pressure to back face of outer bearing cone
3 - Spring scale

3. Rotate pinion cage while applying press load (see chart below) to the assembly and check rolling torque. Wrap soft wire around the bearing cage, attach spring scale and pull. Preload is correct when torque required to rotate the pinion bearing cage is from 5–13 lbs. (2.5–6.0 kgs.).

Specifications for Pinion Bearing Trial Buildup Preload Test

Torque to Rotate Bearing Cage (w/o pinion seal)
18 - 42 in. lbs (2.0 - 4.7 N•m)

	Forward Axles	Rear Axles
Spring Scale Reading	5 - 13 lbs. (2.5 - 6.0 kgs.)	
Press Loads	17-19 Tons (15.4 - 17.2 Metric Tons)	14-15 Tons (12.7-13.6 Metric Tons)
Nominal Bearing Thickness Spacer	0.496 in. (12.60 mm)	0.638 in. (16.21 mm)

⚠ CAUTION

Read only the torque value after the bearing cage starts to rotate.

4. If necessary, adjust pinion bearing preload by changing the pinion bearing spacer. A thicker spacer will decrease preload. A thinner spacer will increase preload.

⚠ IMPORTANT

Once correct bearing preload has been established, note the spacer size used. Select a spacer 0.001" larger for use in the final pinion bearing cage assembly. The larger spacer compensates for slight "growth" in the bearings which occurs when they are pressed on the pinion shank.

Do not assume that all assemblies will retain proper preload once bearings are pressed on pinion shank. FINAL PRELOAD TEST MUST BE MADE IN EVERY CASE.

Final Buildup

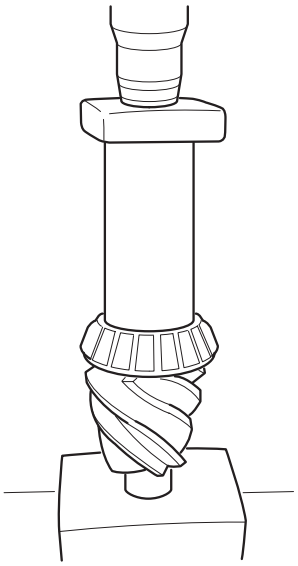
Note: On rear axles, do not install oil seal in cage until bearing preload is correctly adjusted.

⚠ IMPORTANT

After bearing cups are installed, preselect pinion bearing spacer using the "trial buildup" procedure.

Note: During pinion bearing installation, locate each part in same position that was used in "trial buildup" preload test.

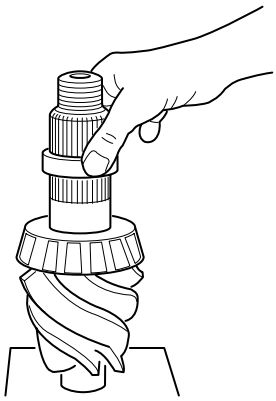
1. Press inner bearing cone on pinion.



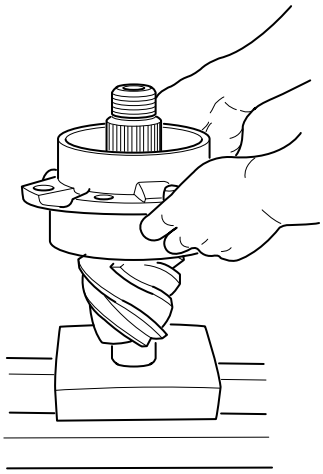
⚠ IMPORTANT

To prevent bearing damage, use suitable sleeve that only contacts inner race of bearing cone.

2. Install preselected bearing spacer.



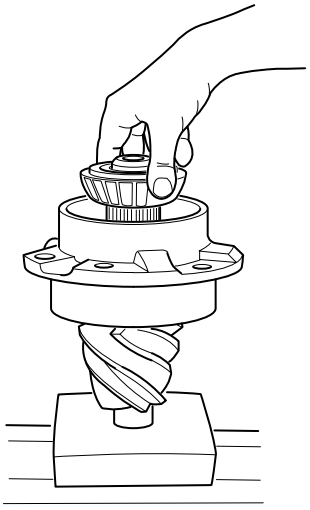
3. Install bearing cage on drive pinion.



4. Press outer bearing cone on pinion.

⚠ IMPORTANT

To prevent bearing damage, spin cage while pressing outer bearing on.



5. Apply clamp load to the pinion bearing cage assembly. Either install the yoke (or helical gear) and torque the pinion nut to specifications or use the press to simulate nut torque (see chart on next page).

Specifications for Pinion Bearing Final Buildup Preload Test

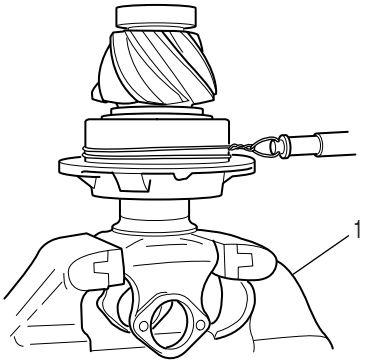
Torque to Rotate Bearing Cage (w/o pinion seal)
18 - 42 lbs. in. (2.0 - 4.7 N•m)

	Forward Axles	Rear Axles
Spring Scale Reading	5 - 13 lbs. (2.5 - 6.0 kgs.)	
Press Loads	17–19 Tons (15.4–17.2 Metric Tons)	14–15 Tons (12.7–13.6 Metric Tons)
Nut Torque	840 lbs. ft.* (1,140 N•m*)	575–703 lbs. ft. (780–953 N•m)

**Torque nut to 840 lbs. ft. (1,140 N•m), then continue tightening nut to align nut slot to nearest hole in pinion shank.*

Vise Method

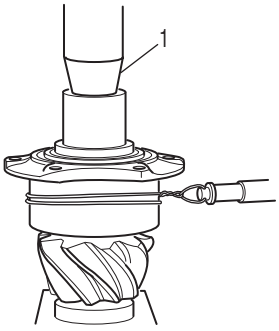
a. if the yoke and nut are used, mount the assembly in a vise, clamping yoke firmly.



1 - Vise

Press Method

a. If a press is used, position a sleeve or spacer so that load is applied directly to the backface of the outer bearing cone.



1 - Press

6. Measure Pinion Bearing Preload: Use a spring scale to test the assembly rolling torque. To use the spring scale, wrap flexible wire around the bearing cage, attach the scale and pull. Preload is correct when torque required to rotate the pinion bearing cage is from 5–13 lbs. This specification is translated into lbs. in. readings in the previous chart.

⚠ CAUTION

Read only the torque value after the bearing cage starts to rotate.

7. Adjust Pinion Bearing Preload: If necessary, adjust pinion bearing preload. Disassemble the pinion bearing cage as recommended in this manual and change the pinion bearing spacer. A thicker spacer will decrease preload. A thinner spacer will increase preload.

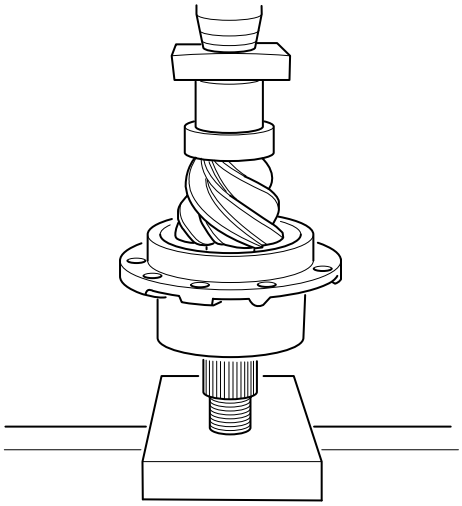
⚠ IMPORTANT

Use the correctly sized spacer. Do not use shim stock or grind spacers. These practices can lead to loss of bearing preload and gear or bearing failure.

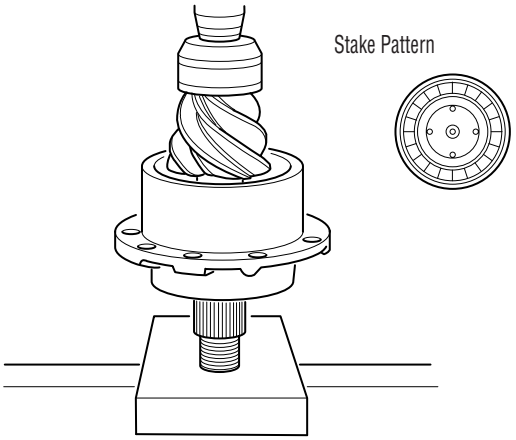
8. Press pilot bearing on pinion.

⚠ IMPORTANT

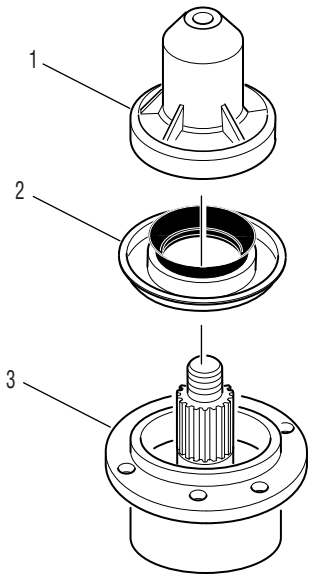
To prevent bearing damage, use suitable sleeve that only contacts the inner race of bearing cone.



9. Stake pilot bearing using staking tool. This is essential to retain the bearing.

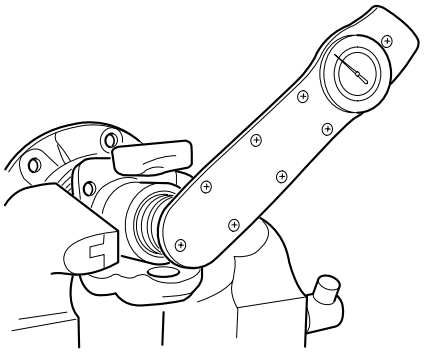


10. **Rear Axle Only:** With pinion installed and bearing preload adjustment complete, install oil seal. Use properly sized installation tool as described on page 71 to prevent distortion.



1 - Tool
2 - Seal
3 - Bearing cage

11. **Rear Axle Only:** Prior to installation of yoke, make sure yoke is clean and dry.

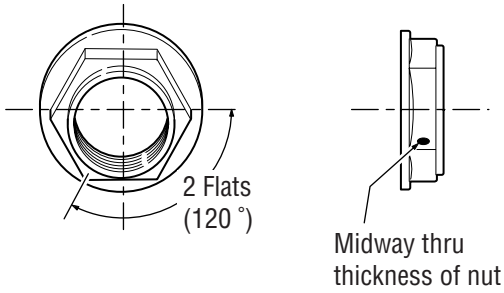


12. Install yoke.
13. Install yoke nut using one of the following options:
    a. Install a new nut with the pre-applied thread adhesive compound. Tighten the nut to the specified torque:
    - 575–703 lbs. ft. (780–953 N•m) for rear pinion nut.
    - 840–1020 lbs. ft. (1140–1383 N•m) for front pinion nut.

    b. If a new nut with pre-applied thread adhesive compound is unavailable, apply “Loctite 277” or “271” (available in .5 ml tube – P/N 129293) to the nut along two threads, for at least two flats (120°) of the nut midway through the thickness.

⚠ IMPORTANT

Follow the instructions specified by the thread adhesive manufacturer when applying thread adhesive compound.



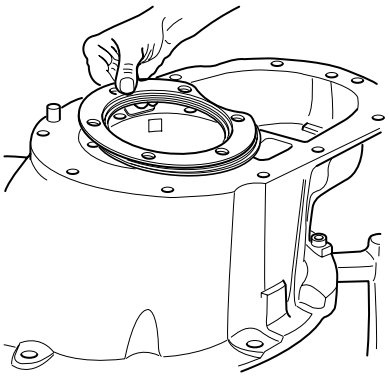
Note: Use of a torque multiplier is recommended.

TIP: If you can't get the correct torque on yoke nut, try torquing the nut with the truck wheels on the ground and with the axle shafts installed.

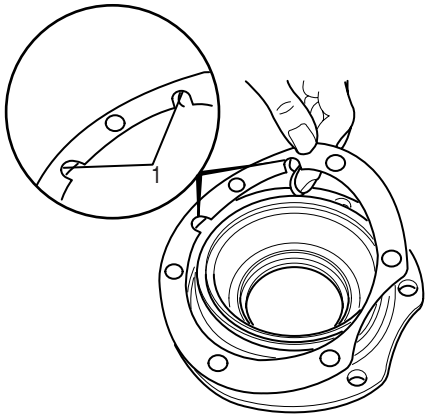
Note: Forward axle pinion helical gear and bearing: These parts are installed after pinion installation in carrier (see page 54).

Install Drive Pinion Assembly

1. **Forward Axle Only:** Place shim pack on carrier making sure holes are properly aligned. Make sure shims are flat with no kinks or bends.



2. **Rear Axle Only:** Place shim pack on carrier making sure lube holes are clear.



1—Lube slots

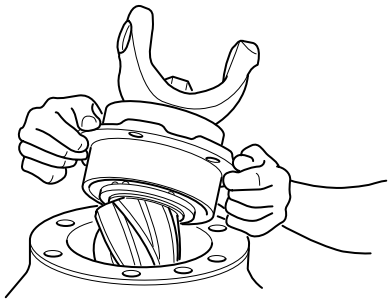
Note: If gear set is to be reused, install same quantity and size of shims removed during disassembly. When installing a new gear set, use nominal shim pack indicated.

Nominal Shim Pack

Axle	in.	mm
Forward	0.025	0.635
Rear	0.023	0.584

3. Install drive pinion assembly. Install bearing cage capscrews and lock washers. Torque capscrews to 114-140 lbs. ft. (155-190 N•m).

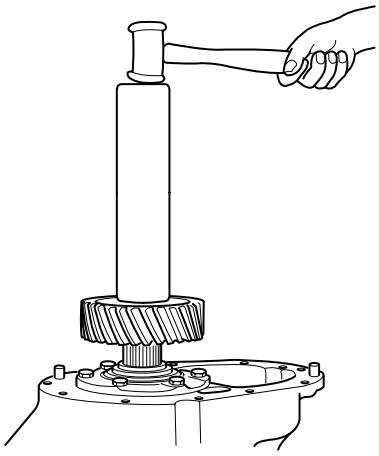
Note: Use a dummy yoke (if available) in place of helical gear. This will result in easier disassembly and reassembly during carrier adjustments.



Note: Do not install cotter pin until carrier adjustments are completed.

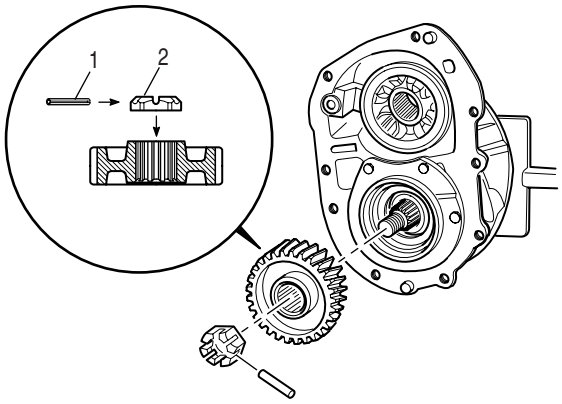
4. **Rear Axle Drive Pinion:** Install pinion assembly. Install bearing cage capscrews and lock washers. Torque capscrews to 114-140 lbs. ft. (155-190 N•m).

5. **Forward Axle Helical Gear Only:** If dummy yoke was used, remove nut and yoke. Install helical gear on pinion. Install M42 X 1.5 nut and torque to 840-1,020 lbs. ft. (1,140-1,383 N•m).



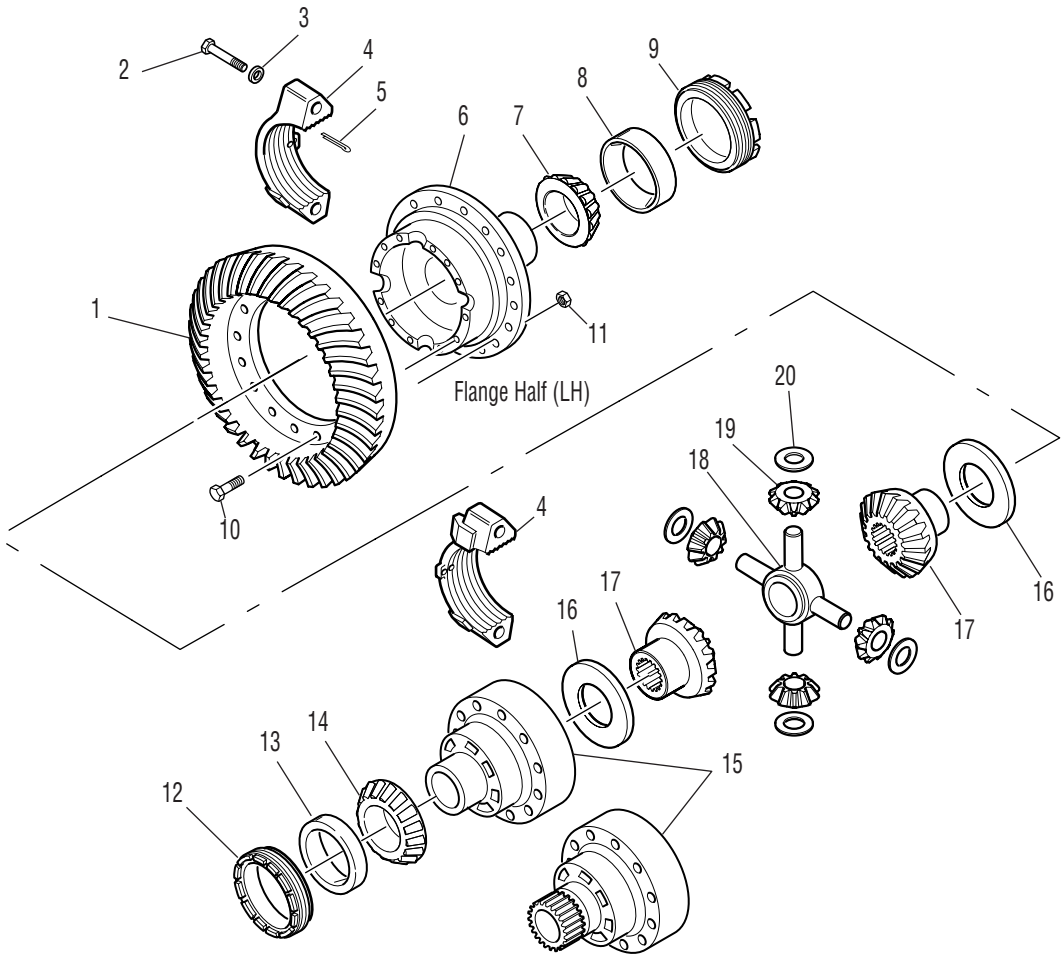
⚠ IMPORTANT

Torque to 840 lbs. ft. (1,140 N•m), then continue tightening nut to align slot with the nearest hole in pinion shank. Install roll pin.



1—Roll pin
2—Slotted nut

Wheel Differential - Parts Exploded View



1 - Ring gear
2 - Capscrew
3 - Flat washer
4 - Diff. carrier bearing caps
5 - Cotter pin
6 - Diff. case - LH (flange half)
7 - Bearing cone - flange half
8 - Bearing cup - flange half
9 - Diff. brg. adjuster - flange half
10 - Bolt
11 - Nut
12 - Diff. brg. adjuster - plain half
13 - Bearing cup - plain half
14 - Bearing cone - plain half
15 - Diff. case - RH (plain half)
16 - Side gear thrust washer
17 - Side gear
18 - Diff. spider
19 - Side pinion
20 - Side pinion thrust

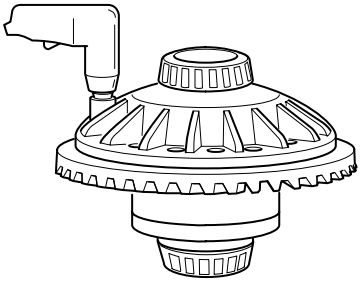
Disassemble, Overhaul, and Assemble Wheel Differential (Forward and Rear Axles)

Disassemble Wheel Differential

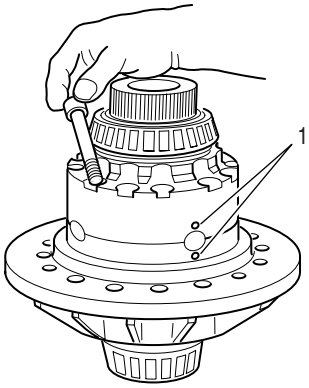
IMPORTANT

During following procedure, place differential assembly on malleable surface to prevent damage when ring gear falls off its mounting position.

1. Remove nuts and bolts fastening ring gear to differential cases, allowing gear to fall free. If gear does not fall, tap outer diameter with soft mallet to loosen.

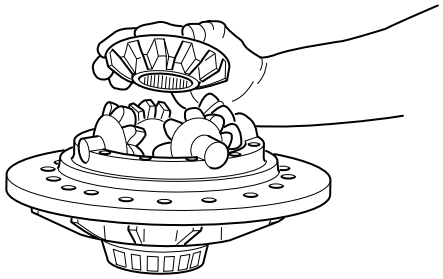


2. Punch mark differential cases for correct location during reassembly. Remove capscrews and lift off plain differential case half.

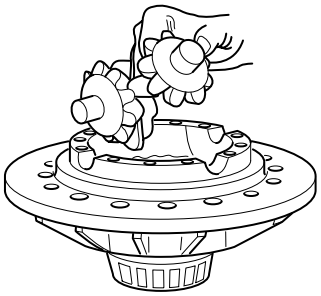


1 - Punch marks

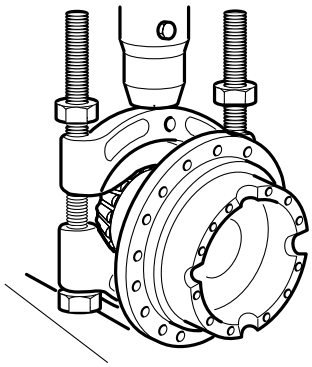
3. Lift out side gear and thrust washer.



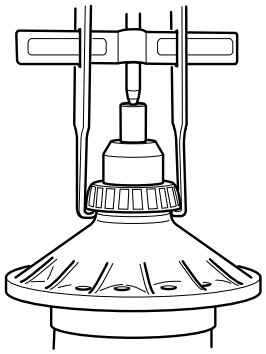
4. Lift out spider, side pinions and thrust washers.



5. Remove remaining side gear and thrust washer.
6. Remove bearing cones from case halves using suitable puller.
7. Remove bearing cone from plain case half in two steps:
   a. Mount puller vertically to split bearing. This action will start moving bearing off case.



   b. Mount puller horizontally to remove cone.



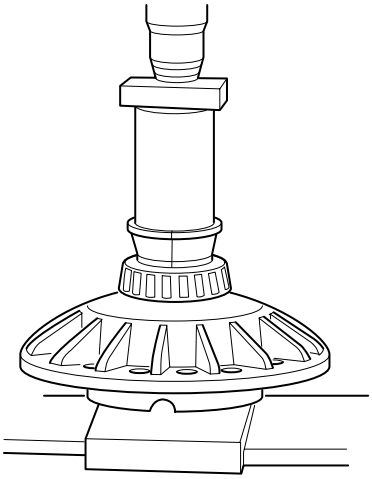
8. Remove bearing cone from flanged case half using suitable puller.

Overhaul and Assemble Wheel Differential

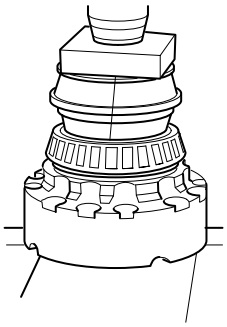
⚠ IMPORTANT

To prevent bearing damage, use suitable sleeve that only contacts the inner race of the cone. A used bearing race would be a suitable tool. This tool should have a slit cut if the ID is the same as the flange OD.

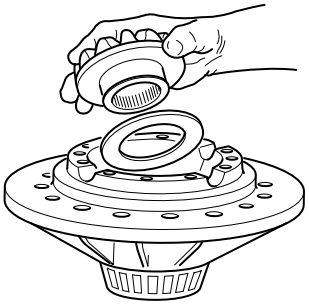
1. Press new flange half bearing cones on differential case halves.



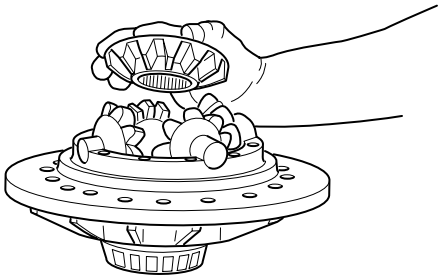
2. Press new plain half bearing cones on differential case halves.



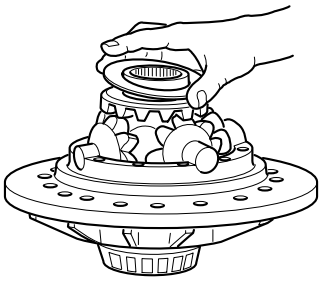
3. Place thrust washer and side gear in flanged differential case.



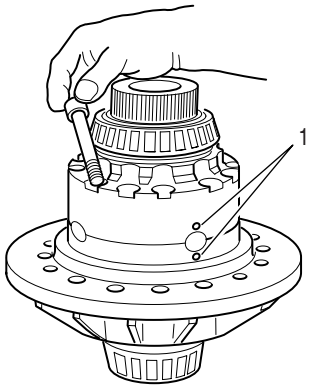
4. Lubricate all differential parts.
5. Assemble side pinion and thrust washers on spider. Place this assembly in flanged differential case. Rotate gears and check for proper mesh.



6. Place side gear and thrust washer on side pinions.



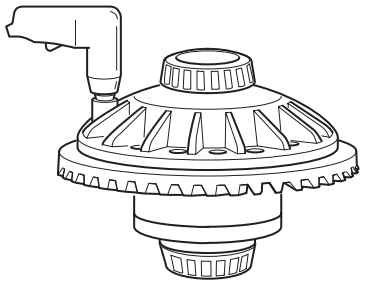
7. Align punch marks and install plain case half. Install capscrews and tighten to 114–140 lbs. ft. (155–190 N•m). Check differential for free rotation by turning side gear hub.



1 - Punch marks

8. Install ring gear. Secure with bolts and nuts.

Note: Flange half differential cases were redesigned starting with production axles built in January 1997. New style ring gear bolts are also required with the new style flange case, the torque specification for this bolt is different than the old 126219 bolt. (See chart).



Bolt No.	Torque Specs.
129686	260-280 lbs. ft. (N•m 352-380)
126219	215-255 lbs. ft. (N•m 292-346)

Ring Gear Bolt Torque Turn Specification

Bolt No.	Torque	Turn Angle
129686	125 Nm (92 ft. lbs)	65°

A. With a calibrated torque wrench, torque each ring gear bolts to 125 Nm in a crisscross pattern.

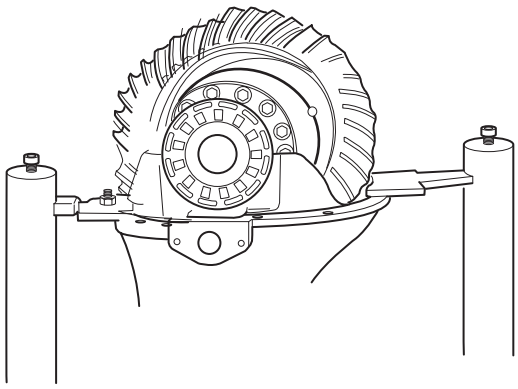
B. With a torque wrench that reads torque turn angle, tighten each fastener clockwise, 65 degrees.

IMPORTANT NOTE: If the torque exceeds 447 Nm (330 ft. lbs.) when the 65^{o} turn angle is achieved, the bolt and nut need to be replaced.

Reference Spicer Bulletin ABIB-9701 for more details.

9. Lower assembled differential assembly in to the carrier using a hoist and a strap. Be careful not to damage the differential bearings lowering the assembly.

10. Install the bearing cup and bearing adjuster to the flange half side first.

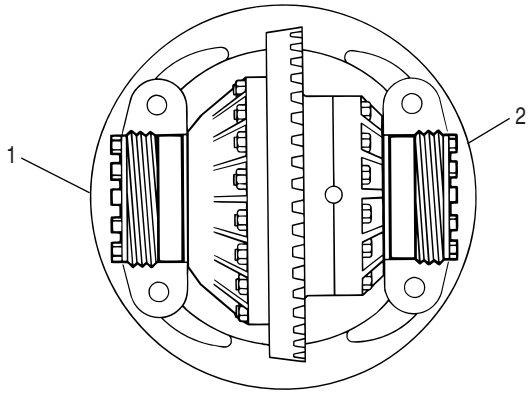


11. Install the bearing cup and bearing adjuster to the plain half side. Use a long screwdriver or bar to lift the differential up while installing the cup and bearing adjuster.

Measure and Adjust Carrier Assembly

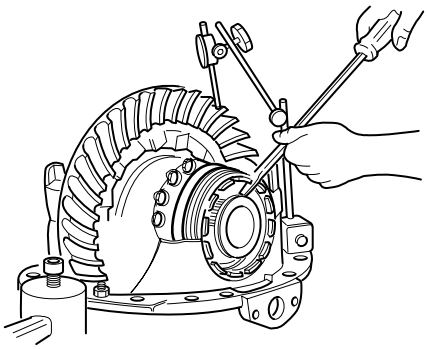
Adjust Backlash and Preload

1. Turn the flange half bearing adjuster in until the ring gear contacts the pinion (zero backlash) than back the adjuster out two notches of the adjuster lugs.

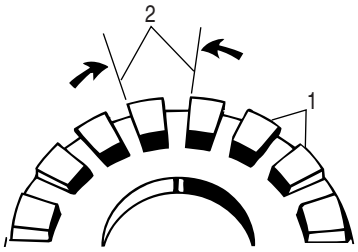


1—Flange half
2—Plain half

2. Tighten the plain half adjuster until the bearing cup just starts to turn, this is a zero bearing preload.



3. Tighten the plain half adjuster two lug notches. Start with the notch at the top, count two notches counterclockwise on the adjuster, turn the adjuster so that the notch is facing straight up. You now have a two notch preload.



1—Flange half
2—Plain half

4. Use a rubber mallet to make certain that both bearing adjusters are fully seated.
5. Measure backlash. Make sure it is within specification of .006"–.018".

   TIP: To give yourself room to adjust contact pattern, set it between .010"–.012".

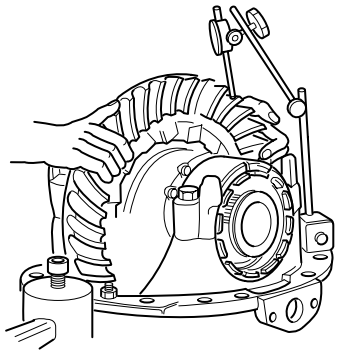
Change Backlash Setting

If you have too much backlash the ring gear needs to move closer to the pinion. Back off the plain half adjuster, count the number of notches you back it off, each notch equals about .003" of backlash.

⚠ IMPORTANT

In order to maintain the differential bearing preload you will need to turn the flange half bearing adjuster the same amount in the same direction. If you need more backlash reverse this procedure.

1. Install carrier bearings caps and torque carrier cap bolts to 350–428 lbs. ft. (475–580 N•m).
2. **Recheck backlash:** if the bearing adjusters were not in straight or fully seated the backlash will change.
   a. **Used Gearing:** Reset to backlash recorded before disassembly.
   b. **New Gearing:** Backlash should be between 0.006 and 0.018".

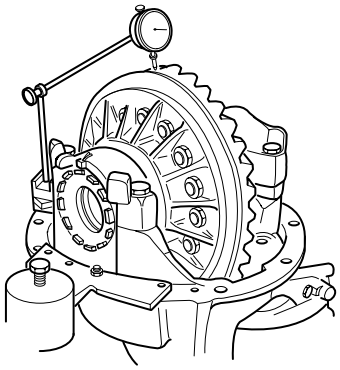


3. Check ring gear tooth contact pattern. Paint ring gear teeth and check tooth contact pattern. Correct tooth patterns. Checking and adjusting procedures are on pages 61-62.
4. Install bearing adjuster cotter pins.

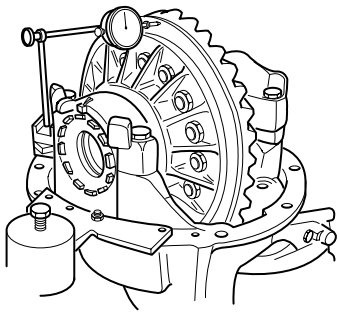
Measure Ring Gear Runout

Measure Ring Gear Total

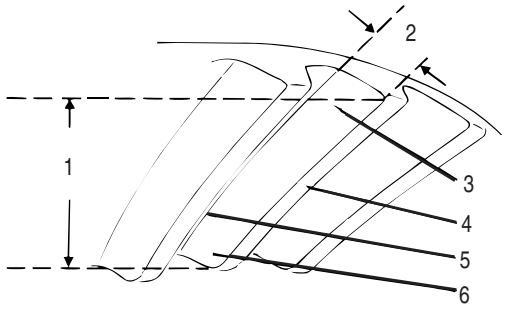
1. Measure ring gear total radial run out. (Indicator reading should not exceed .010").



2. Measure ring gear total back face run out (Indicator reading should not exceed .010").



Adjust Ring and Pinion Tooth Contact Pattern



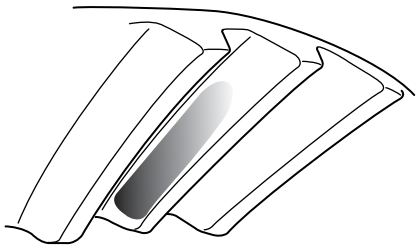
1 - Face width
2 - Tooth Depth
3 - Heel
4 - Top land
5 - Root
6 - Toe

Note: Rear axle gearing is shown in the following instructions. Correct tooth contact patterns and adjustments are the same for forward and rear axles.

1. Identify if new or used gearing.
2. Check tooth contact pattern (new or used gearing).

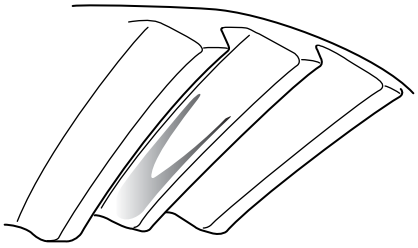
New Gearing - Correct Pattern
Paint six ring gear teeth 180° apart with marking compound and roll the gear to obtain a contact pattern. The correct pattern is slightly below center on the ring gear tooth with lengthwise contact up off the toe. The length of the pattern in an unloaded condition is approximately one-half to two-thirds of the ring gear tooth in most models and ratios.

The pattern could vary in length and should cover 1/2 tooth or more (face width). The pattern should be evenly centered between tooth top land and root and should be up off the tooth toe.



Used Gearing - Correct Pattern
Used gearing will not usually display the square, even contact pattern found in new gear sets. The gear will normally have a "pocket" at the heal end of the gear tooth. The more use a gear has had, the more the line becomes the dominant characteristic of the pattern.

Adjust used gear sets to display the same contact pattern observed before disassembly. A correct pattern is up off the toe and centers evenly along the face width between the top land and root. Otherwise, the length and shape of the pattern are highly variable and is considered acceptable as long as it does not run off the tooth at any point.



1 - Pattern along the face width could be longer

Adjust Contact Pattern
If necessary, adjust the contact pattern by moving the ring gear and drive pinion.

- Ring gear position controls the backlash. This adjustment moves the contact pattern along the face width of the gear tooth.
- Pinion position is determined by the size of the pinion bearing cage shim pack. It controls contact on the tooth depth of the gear tooth.

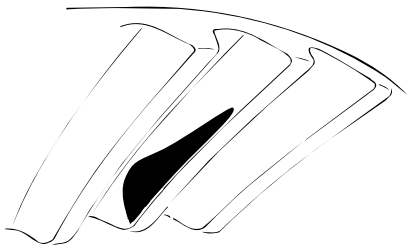
These adjustments are interrelated. As a result, they must be considered together even though the pattern is altered by two distinct operations. When making adjustments, first adjust the pinion, then the backlash. Continue this sequence until the pattern is satisfactory.

Adjust Pinion Position

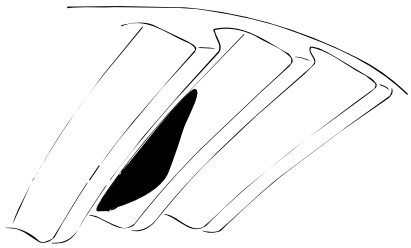
If the gear pattern shows incorrect tooth depth contact, change drive pinion position by altering the shim pack. Used gears should achieve proper contact with the same shims removed from the axle at disassembly.

Note: Check ring gear backlash after each shim change and adjust if necessary to maintain the 0.006" to 0.018" specifications.

If the pattern is too close to the top land of the gear tooth, remove pinion shims. Move pinion toward the ring gear.



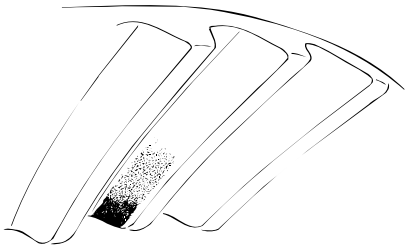
If the pattern is too close to the root of the gear tooth, add pinion shims. Move pinion away from the ring gear.



Adjust Ring Gear Position (Backlash)

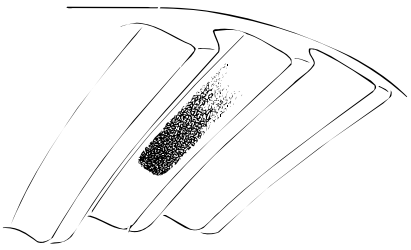
If the gear pattern shows incorrect face width contact, change backlash by adjusting the ring gear.

If the pattern is too close to the edge of the tooth toe, move the ring gear away from the pinion to increase backlash.



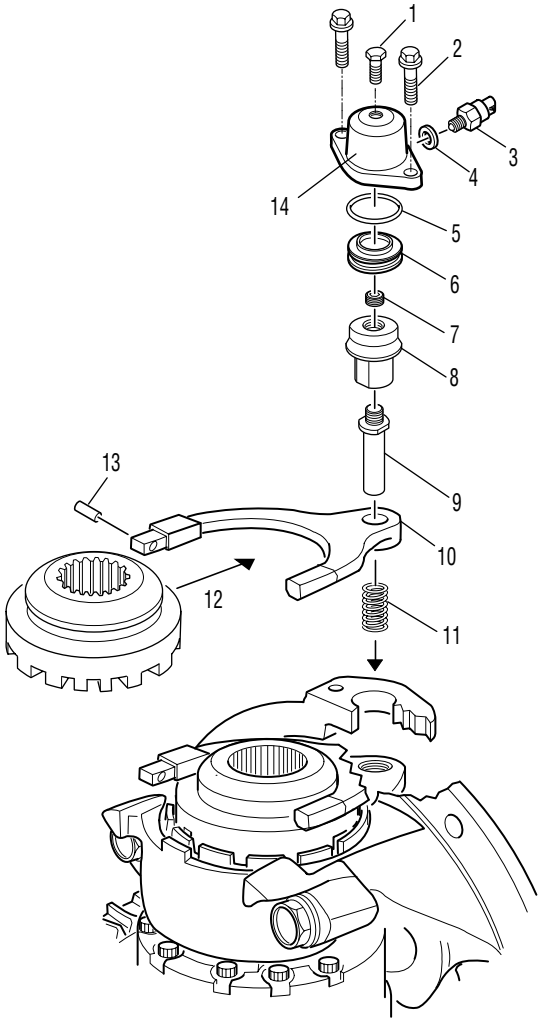
1. Loosen the bearing adjuster on the teeth side of the ring gear several notches.
2. Loosen the opposite adjuster one notch.
3. Return to adjuster on teeth side of ring gear and tighten adjuster until it contacts the bearing cup.
4. Continue tightening the same adjuster 2 or 3 notches and recheck backlash.

If the pattern is concentrated at the heel (too far up the tooth), move the ring gear toward the pinion to decrease backlash.



5. Loosen the bearing adjuster on the teeth side of the ring gear several notches.
6. Tighten the opposite adjuster one notch.
7. Return to adjuster on teeth side of ring gear and tighten adjuster until it contacts the bearing cup.
8. Continue tightening the same adjuster 2 or 3 notches and recheck backlash.

Wheel Differential Lock - Parts Exploded View

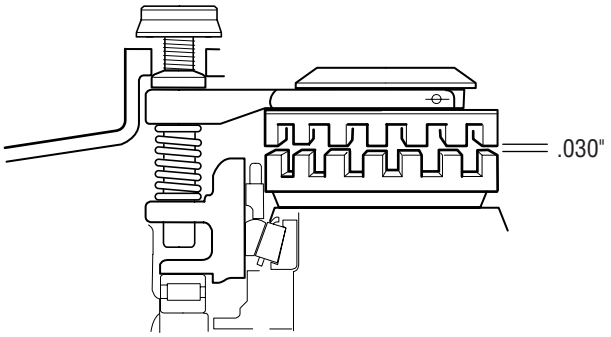


1—Piston engagement bolt
2—Capscrew
3 —Switch
4—Washer
5 —O-ring
6 —Piston
7—Setscrew
8 —Piston driver
9—Pushrod
10—Clutch fork
11—Spring
12—Sliding clutch
13—Pin
14—Piston cover

Install and Adjust Wheel Differential Lock

Note: With differential carrier completely assembled and adjusted, install differential lock as follows:

1. Install fixed curvic clutch on splined hub of flanged differential case, then install snap ring.
2. If shift fork and sliding curvic clutch are disassembled, engage fork with clutch hub and install spring pin in the long leg of the fork. See illustration for fork mounting position on clutch.
3. Position compression spring, shift fork and clutch assembly in shift opening of the carrier. Align pilot hole of shift fork with pilot hole of carrier. Install pushrod, engaging shift fork head, and compression spring in carrier.
4. Install new o-ring on piston.
5. Lubricate piston and o-ring with silicone grease and install piston assembly in cylinder. Position piston with small diameter hub toward closed end of cylinder.
6. Screw piston driver on push rod.
7. Tighten piston driver until shift fork clutch is approximately .030 of an inch from the fixed clutch.



8. Push down by hand on the piston driver, both clutches must be completely engaged.
9. Install set screw in piston driver, torque to 12–15 lbs. ft. (16–20 N•m).

⚠ CAUTION

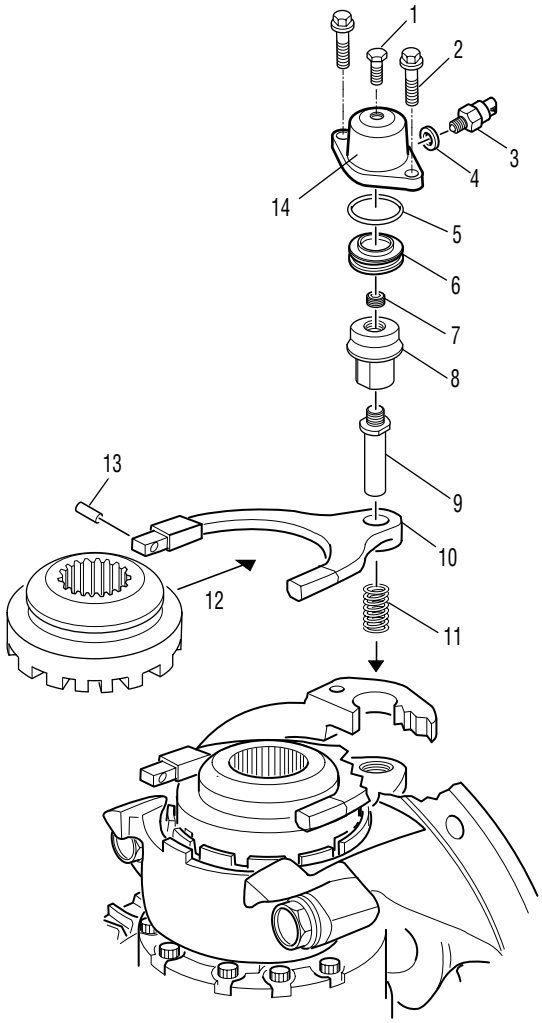
On 3.90 ratio models only, a washer (P/N 210288) must be used between the piston driver and piston. Failure to install the washer will cause engagement and disengagement problems in the differential lock.

10. Trial fit, install piston cover assembly. Hand tighten capscrews.
11. Screw in manual engagement screw, by hand approximately 1 inch or until snug fit (light resistance pressure is felt) both clutches must be completely engaged.
12. Remove manual engagement screw, clutches must completely disengaged. Repeat above procedure if clutches not completely disengaged.

Note: Fork adjustment is correct when curvic clutch teeth are fully engaged with the fork free when moved by hand. When air pressure is released or the manual bolt is removed, the shift assembly should disengage freely.

13. When adjustment is complete, torque fasteners to 28–35 lbs. ft. (38–47 N•m).
14. Install selector switch in cylinder cover. Torque switch to 10–12 lbs. ft. (14–16 N•m).

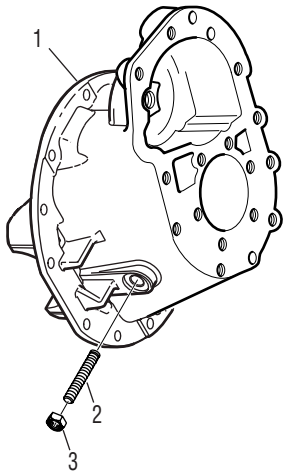
15. Check selector switch operation. Check switch electrically with an ohmmeter or continuity tester. Switch should close (show continuity) when clutches are engaged and should open (no continuity) when clutches are disengaged.



1 - Piston engagement bolt
2 - Capscrew
3 - Switch
4 - Washer
5 - O-ring
6 - Piston
7 - Setscrew
8 - Piston driver
9 - Pushrod
10 - Clutch fork
11 - Spring
12 - Sliding clutch
13 - Pin
14 - Piston cover

Install and Adjust Ring Gear Thrust Bolt

1. Thread thrust screw into the carrier until firm contact with the back face of the ring gear is made.
2. Loosen the thrust screw 1/4 turn to obtain the correct adjustment of .020" (.50mm) clearance between gear face and screw. Tighten jam nut, holding thrust screw stationary with a wrench, torque jam nut 150–190 lbs. ft. (203–258 N•m).
3. Recheck to assure minimum clearance during full rotation of ring gear.

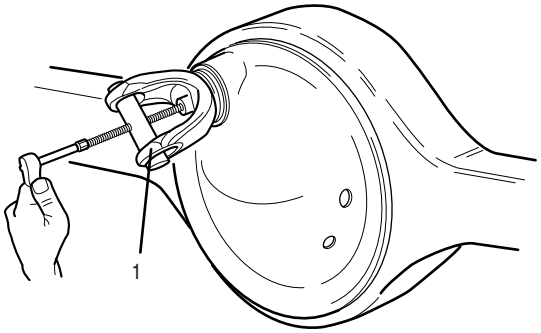


1 - D-head carrier or front carrier
2 - Thrust bolt
3 - Thrust bolt jam nut

Remove Output Shaft Assembly

Note: For forward axle rear covers that are removable the output shaft may be removed when the cover is in or out of the axle assembly.

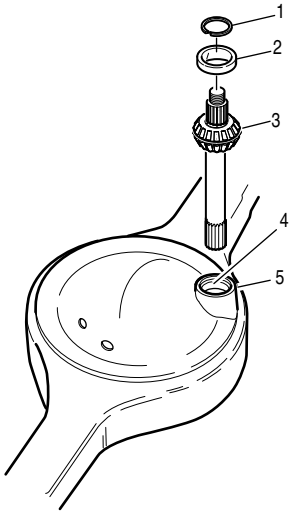
1. Disconnect the inter-axle driveline at the forward axle rear cover position.
2. Remove yoke nut (shoulder nut).
3. Remove yoke from output shaft using appropriate tool.



1 - Yoke puller tool

TIP: A yoke puller tool may be made from the center section of most gear puller tools, or may be purchased from your tool distributor.

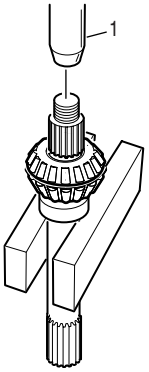
4. Remove oil seal.
5. Remove snap ring.
6. Remove output shaft and outer bearing cup as an assembly.



1 - Snap ring
2 - Outer bearing cup
3 - Output shaft assembly
4 - Inner bearing cup
5 - Rear cover assembly

TIP: It may be helpful to loosely reinstall the yoke and shoulder nut giving the technician more of an area to grip when removing the output shaft.

7. Remove the inner bearing cup from rear cover assembly. This may be removed from inside the axle housing when the carrier is removed, or by removal of the forward axle rear cover.
8. Remove both inner and outer bearing from output shaft.



1 - Press

9. Remove output shaft inner bearing cup.

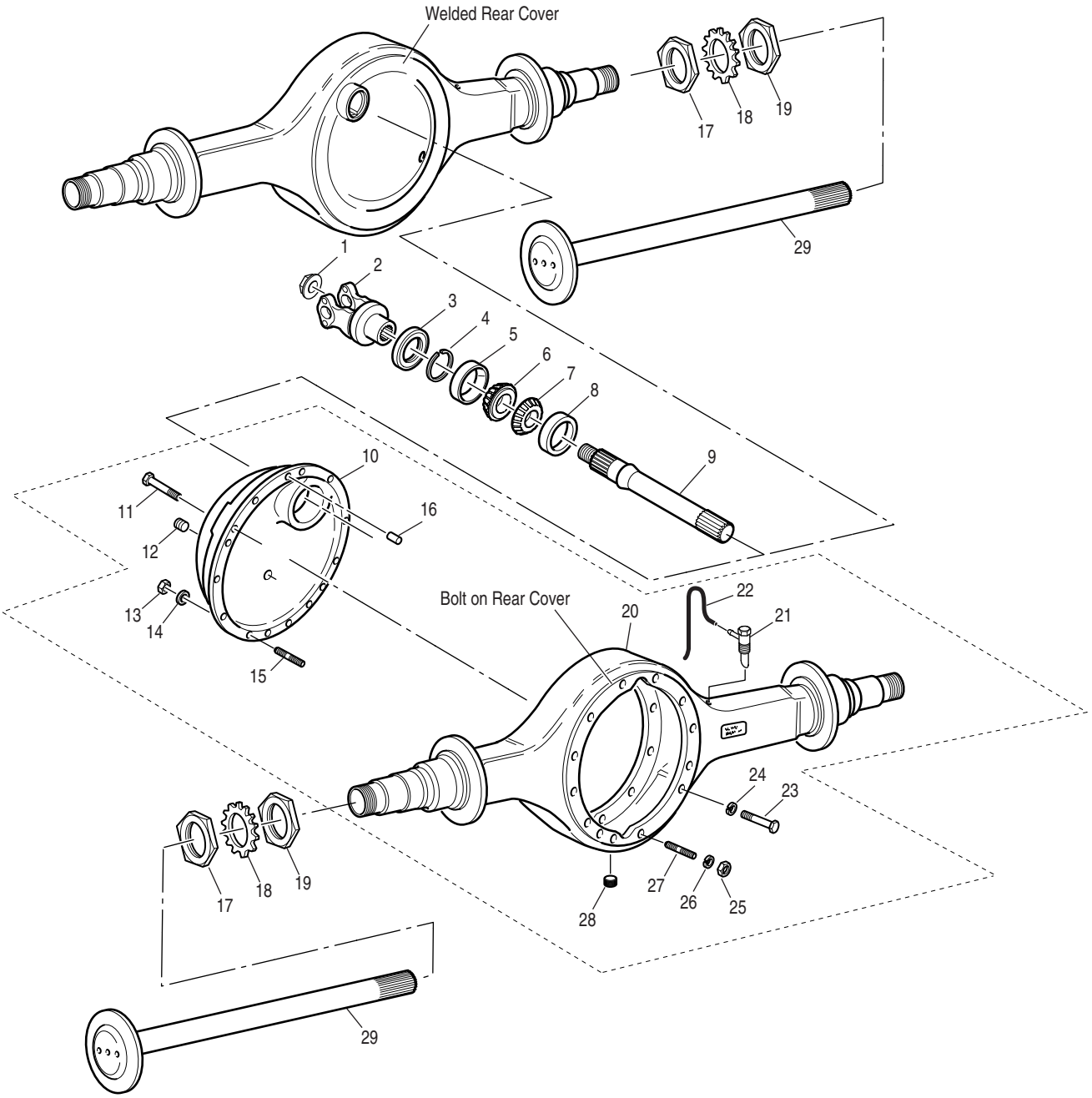
Note: On 11/02/98, a design change was made to the forward axle housing in the 404 family axles. The rear axle housing cover is now a welded assembly. To replace the inner output shaft bearing cup on axle housings that have the welded-on D-Cover, follow the steps outlined below.

Note: Components such as the inter-axle driveline, yoke, oil seal and output shaft assembly should have been removed according to normal service procedures. Removing the differential assembly from the axle housing is not necessary, but would ease the removal process of the inner bearing cup from the cover bore.

a. Using a bearing puller tool, remove the inner bearing cup.

b. Visually inspect the inner-machined bore surface of the welded-on cover for nicks and burrs. Repair if necessary.

Housing and Output Shaft Assembly - Parts Exploded View



1— Output shaft nut
2— Output yoke
3— Output seal
4— Snap ring
5— Outer bearing cup
6— Outer bearing cone
7— Inner bearing cone
8— Inner bearing cup
9— Output shaft
10— Rear cover
11— Rear cover capscrew
12— Fill plug
13— Rear cover nut
14— Lock washer
15— Stud
16— Dowel
17— Jam nut
18— Locking ring
19— Spindle nut
20— Axle housing
21— Breather
22— Breather hose
23— Carriage capscrew
24— Lock washer
25— Nut
26— Lock washer
27— Stud
28— Drain plug
29— Axle shaft

Overhaul and Assemble Output Shaft Assembly

Note: Lubricate the parts with gear lube during assembly.

1. The output shaft bearings are assembled with both bearing cones back to back. Use a press and a sleeve to install one bearing at a time.

⚠ CAUTION

To prevent bearing damage, use a suitable sleeve that only contacts the bearing race.

2. Apply pressure until the inner bearing cone touches the shoulder of the output shaft.
3. Apply pressure until the back of the outer bearing cone touches the back of the inner bearing.

Note: Axle housings with welded-on covers procured through service will include the inner bearing cup as part of the "service" axle housing assembly. Go to Step 6 if the inner cup has already been installed.

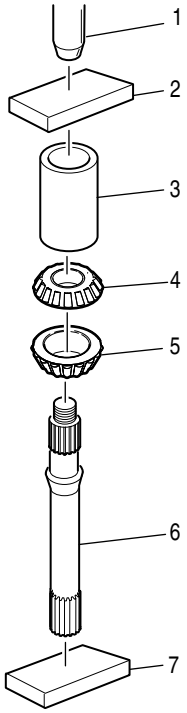
4. Lightly coat the output bore of the axle housing cover with a 9.5 (.38) wide application of Loctite 680 where the bore contacts the inner bearing cup. Do not apply Loctite outside of this area—to the bearing rollers or outboard of the inner cup bore. Improper application of the Loctite could lock the rollers or cause excessive pre-load.

⚠ CAUTION

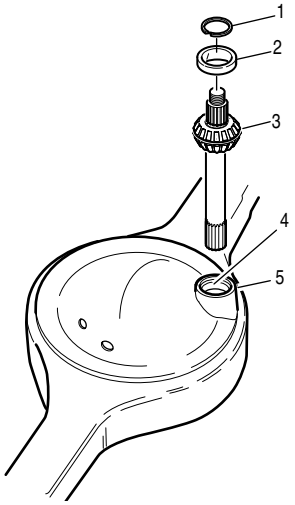
Add loctite adhesive to the inner bearing surface of the housing and NOT to the bearing race itself. If added to the race, excessive adhesive could get on the surface of the outer bearing race journal during installation and cure the outer cap in place with excessive pre-load.

5. Using a sleeve and driver (hammer), install the inner bearing cup.
6. Put the output shaft and bearing assembly into the axle housing assembly.
7. Using a sleeve and driver (hammer), install the outer bearing cup into the housing assembly over the output shaft bearing cone.
8. Using snap ring pliers, install the snap ring that fastens the outer bearing cup into the welded-on cover assembly.
9. Check the end-play of the output shaft. New assemblies should measure .001" to .015".

Note: Use the bearing cup driver to insure seating of snap ring after installation with snap ring pliers.



1—Press
2—Plate
3—Sleeve
4—Press bearing on second
5—Press bearing on first
6—Output shaft
7—Plate

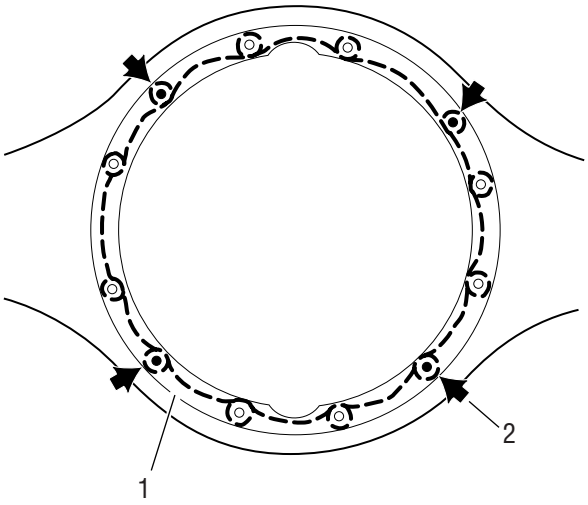


1—Snap ring
2—Bearing cup
3 —Output shaft assembly
4—Inner bearing cup
5—Rear cover assembly

10. **Bolted rear cover only:** If removed, install cover and fasten with nuts, capscrews and lock washers. Tighten to proper torque specifications.

Note: Use Spicer approved RTV compound on axle housing mating surface as shown in illustration. Completely remove all old gasket material prior to applying new material. Compound will set in 20 minutes. Install axle housing cover and output shaft assembly before compound sets or reapply.

Cover Side of Axle Housing

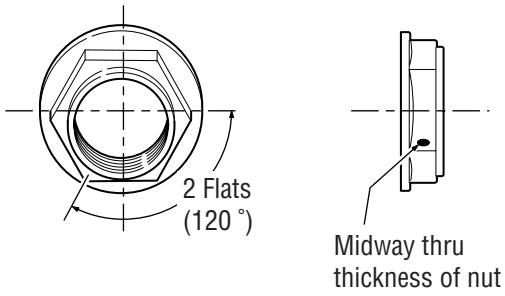


1—Apply silicon gasket in this pattern
2—Stud locations

11. Install output yoke.
12. Install yoke nut using one of the following options:
    a. Install a new nut with the pre-applied thread adhesive compound. Tighten the nut to the specified torque 680–832 lbs. ft. (920–1,130 N•m).
    b. If a new nut with pre-applied thread adhesive compound is unavailable, apply "Loctite 277" or "271" (available in .5 ml tube—P/N 129293) to the nut along two threads, for at least two flats (120°) of the nut midway through the thickness. Tighten the nut to the specified torque 680–832 lbs. ft. (530–1,130 N•m).

⚠ IMPORTANT

Follow the instructions specified by the thread adhesive manufacturer when applying thread adhesive compound.



Note: Use of a torque multiplier is recommended.

⚠ IMPORTANT

If you can't get the correct torque on yoke nut, try torquing the nut with the truck wheels on the ground and with the axle shafts installed.

13. Install axle shafts and axle stud nuts (If used, also install lock washers and taper dowels).
14. Connect inter-axle driveline. Make sure driveline is properly phased. Lubricate U-joints.
15. Add axle lubricant. Fill to bottom of filler hole.

⚠ IMPORTANT

When axle has been disassembled or housing, axle shafts or wheel equipment replaced, check axle assembly for proper differential actions before operating vehicle. Wheels must rotate freely and independently.

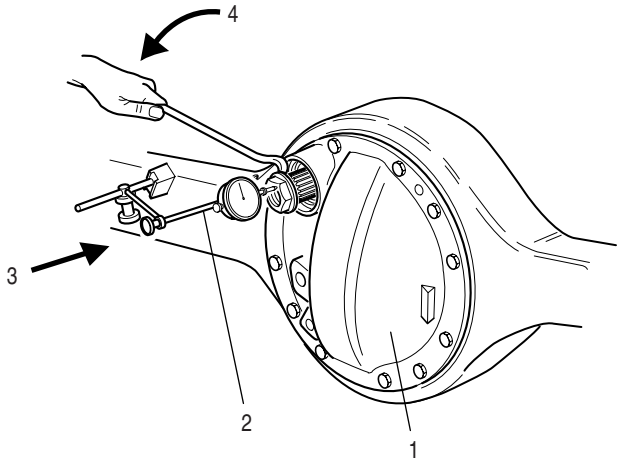
16. Road test vehicle to bring axle lubricant up to temperature. Recheck joints, drain and fill plugs for leakage. Retighten as necessary.

Measure and Adjust

Note: Use bearing cup driver to insure seating of snap ring after installation with snap ring pliers.

See illustration for steps 1–4.

1. Assemble cover assembly to axle housing.
2. Position dial indicator at yoke end of output shaft.
3. Push in on output shaft and zero the dial indicator.
4. Using a pry bar, move output shaft axially and measure/record end-play.



Correct end-play for a new assembly is .001" to .015". The maximum end-play for a used assembly is no more than .015". If end-play is incorrect, contact Dana.

5. Install oil seal. Follow seal replacement procedures on page 72 of this manual.
6. Install yoke.
7. Install yoke nut. One of the following options may be utilized:
   a. Install a new nut with the pre-applied thread adhesive compound. Tighten the nut to the specified torque 680–832 lbs. ft. (920–1130 N•m).
   b. If a new nut with pre-applied thread adhesive compound is unavailable, apply "Loctite 277" or "271" (available in .5 ml tube—P/N 129293) to the nut along two threads, for at least two flats (120°) of the nut midway through the thickness (See illustration). Tighten the nut to the specified torque 680–832 lbs. ft. (920–1130 N•m).

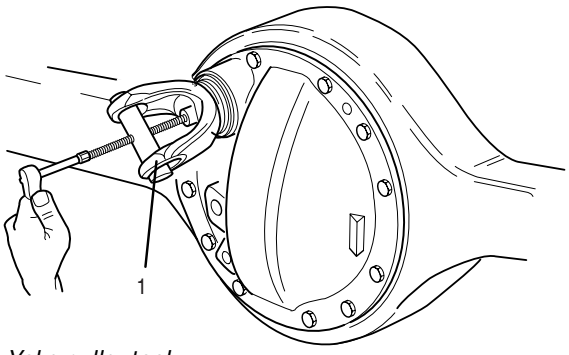
Replace Seal

Dana strongly recommends using seal drivers when installing new seals. Use the proper driver to make sure that the seal is square and installed to the proper depth.

⚠ CAUTION

Oil seals can be easily damaged prior to installation. Use care when handling the new seal to prevent damage or contamination. Leave the seal in its package until installation. On new yokes, leave the protector on the yoke until it is installed on the shaft to prevent damage or contamination.

1. Inspect axle end-play at the yoke (see page 10). Service if beyond specified limit.
2. Remove the old yoke using appropriate tool. A yoke puller tool may be made from the center section of most gear puller tools, or may be purchased from your local tool distributor.



1 - Yoke puller tool

3. Remove seal. Use care when removing the old seal to prevent damage to the housing seal bore.
4. Inspect the seal bore area for any damage (nicks, gouges, corrosion). Carefully remove any slight damage with a crocus cloth. Clean the bore area to remove any loose debris.

⚠ CAUTION

Do not use any silicone or permatex-type bore sealant with this seal.

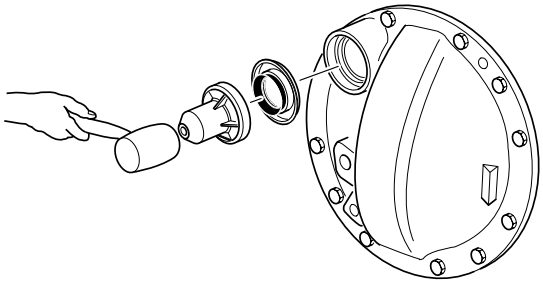
5. Remove the new seal from its package and install with the proper driver:

   Service kit #217414
   D-Input-Use driver #126917 only
   D-Output-Use insert #128706 with driver #126917
   R-Pinion-Use driver #126917 only

⚠ CAUTION

Due to the resiliency of the plastic driver, hammer rebound may occur when the seal is seated. Keep clear of the hammer rebound path!

6. Handle the seal by its outside diameter avoiding any contact with the seal lips. During installation, use the proper driver to make sure that the seal is mounted properly.
7. Use a rubber mallet to drive the seal tool in until the flange bottoms on the housing cover bore face. The flange will locate the seal at the proper depth.



Guidelines for Reusing Yoke

⚠ CAUTION

Do not use the yoke if it has any damage on the seal surface (nicks or scratches).

The surface of the yoke and the lips of the seal form a critical interface which retains the axle's lubricant while sealing the axle from outside contaminants. The condition of the yoke hub's surface is a very important factor in determining seal life.

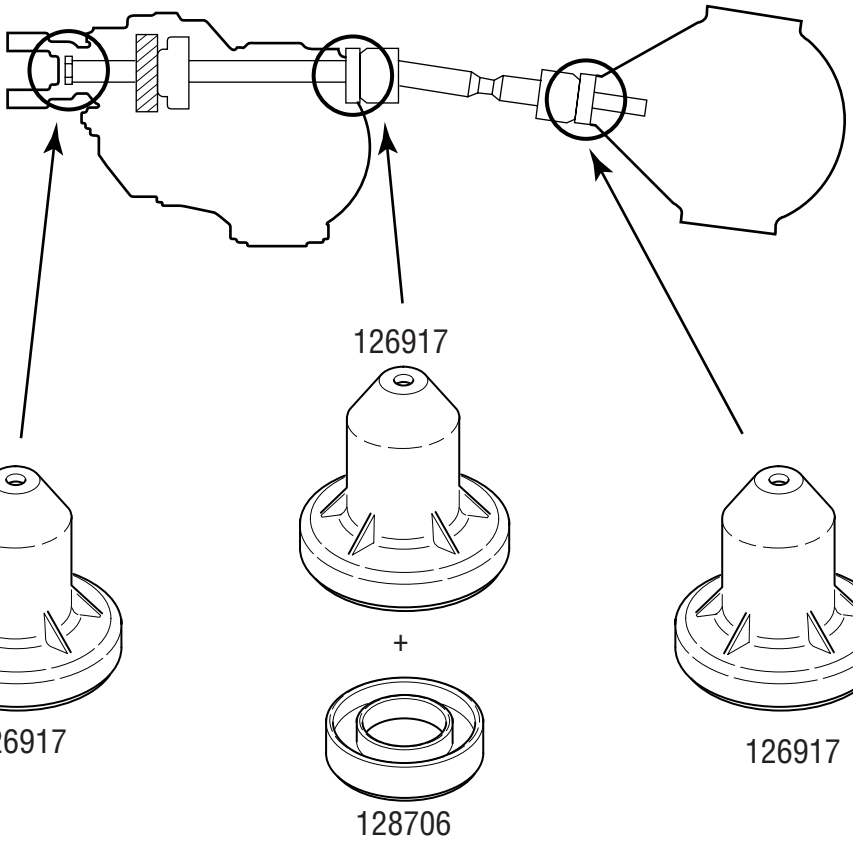
Carefully inspect the seal surface area of the yoke hub for signs of wear and damage. Do not reuse the yoke if there is noticeable wear, such as heavy grooving, beyond normal polishing from the seal lips.

Note: Do not rework the yoke with abrasives such as emery paper or crocus cloth. Clean the surface of the yoke as necessary using chemical cleaners. Remove all trace of the chemicals from the yoke after cleaning.

⚠ CAUTION

Do not use wear sleeves. Wear sleeves increase the yoke hub surface diameter and cause premature seal wear and repeat seal failure.

Service Kit 217414

	D-Input	D-Output	R-Pinion
Location			
Tool	126917	126917 + 128706	126917

New Welded D-Housing Cover

Lube Quantity Difference

0 (zero)

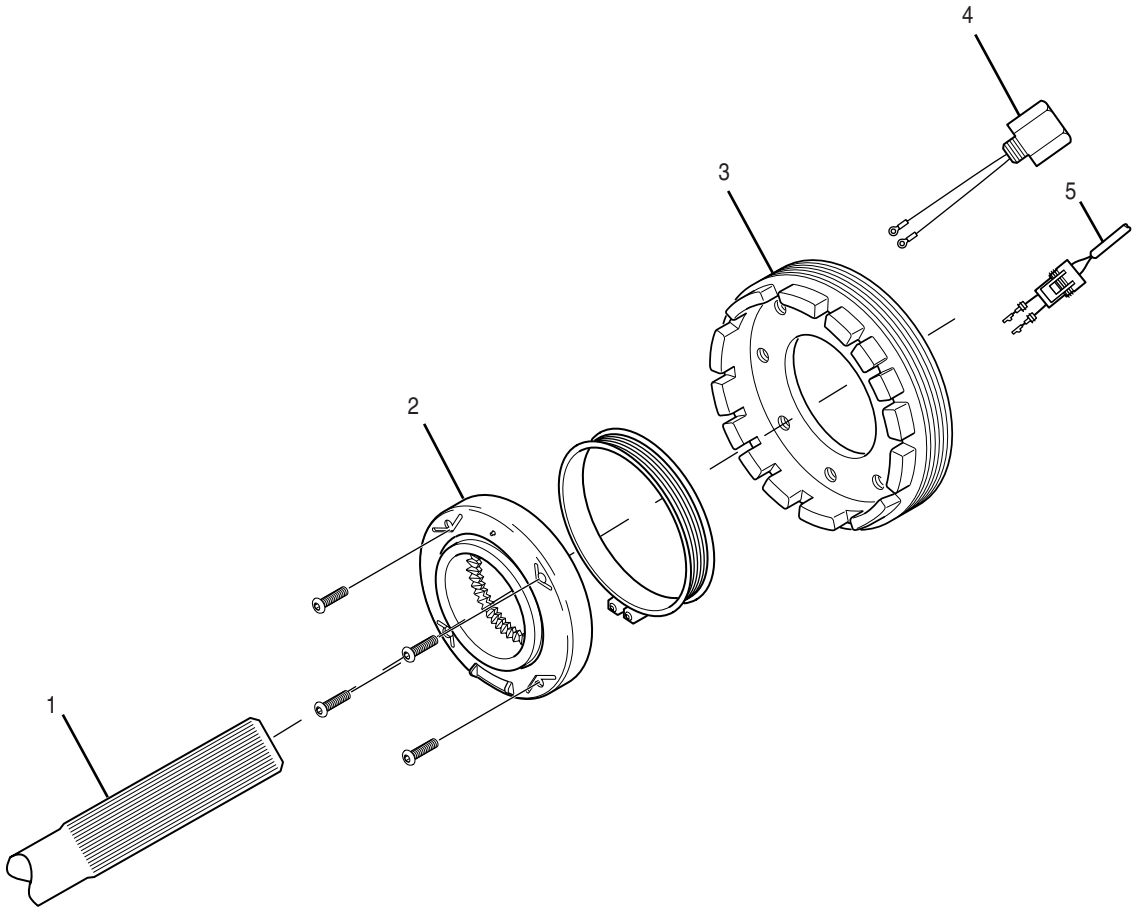
Standout of Output Shaft Yoke

Length increased by 6mm (.25”), this should not have any significant impact on inter-axle driveline length or drive line angles.

Interchangeability of Parts

A cross reference chart of “OLD” axle housing to “NEW” axle housings with welded on covers will be published in a separate bulletin. The bolt on D-Housing covers will remain available for service.

Inter-Axle Speed Sensor - Parts Exploded View



1—Axle shaft
2—Speed sensor
3—Differential bearing adjuster
4—Plated connector
5—ABS Harness connector

Disassemble Inter-Axle Speed Sensor

The design of the drive axle sensor allows replacement of several individual components without disassembling the complete sensor system. For example:

- The differential bearing adjuster does not need to be removed in order to replace any other component.
- The sensor and rotor can be replaced without removing or replacing the plated connector.

At every stage of drive axle service, try to isolate the problem to specific components in order to avoid unnecessary disassembly.

1. Disconnect two wires from sensor terminals.
2. Carefully inspect wires and connector. If connector is intact and if there is no prior indication that connectors and wires require replacement, do not unscrew plated connector. The sensor may be replaced without replacing connector and wire.
3. Remove four screws from face of sensor.
4. Remove sensor from differential bearing adjuster.

Overhaul Inter-Axle Speed Sensor

Note: If plated connector was damaged during axle disassembly or if there is indication of a wiring fault, the connector assembly must be replaced.

There are two different connectors with two different lengths of terminal wires. See Inter-Axle Speed Sensor Service Manual AXSM-0034.

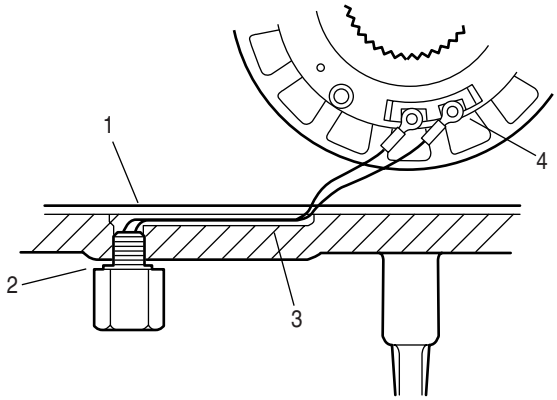
To install new connector:

1. Clean threaded hole in carrier and wire path to allow proper seal for new connector. (Male threads on the new connector have microencapsulated Loctite).
2. Insert connector and torque to 20–28 lbs. ft. (27–38 N•m).
3. Route wires to the sensor location.

If sensor assembly is to be replaced, install new sensor before finishing installation of new connector. The final position of the sensor terminals must be fixed before wires can be sealed in place.

Install Inter-Axle Speed Sensor

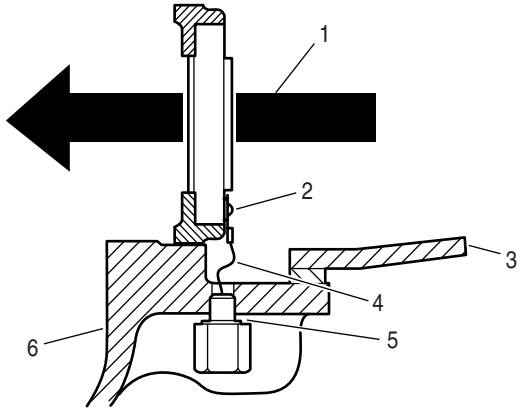
Except for routing the wires between the sensor and the plated connector, procedures for installing both drive axle speed sensors are identical. The instructions which follow cover the long arm (plain half) side speed sensor and require careful routing of the 6 inch long connector wires to prevent pinching between the head and housing.



1—Wires seated in channel
2—Connector hole is on carrier mounting surface
3—6 inch long wires
4—Sensor terminals positioned near carrier mounting surface

1. Lubricate interior rotor with axle lube or grease. Check that the rotor turns freely by hand.
2. Mate the rotor and the sensor assembly.
3. Align the sensor/rotor assembly with the face of the adjuster so that the terminals are nearest the carrier mounting surface.
4. Orient the sensor to line up the holes in the sensor with the threaded holes in the adjuster. Rotate the sensor in either direction to get the fit that keeps the terminals near the carrier mounting surface. This final adjustment should only require a slight shift in sensor position.
5. Apply Loctite to the four mounting screws. Install the screws and tighten in a “star” pattern to maintain sensor alignment. Torque to 28–32 lbs. in. (3.2–3.6 N•m). (A preferred tightening approach is the “turn of bolt” method: torque screws finger tight then tighten additional 1/4 turn).
6. Attach the two round terminals to sensor. Either wire can connect to either sensor blade. Make sure that terminals are not bridged and that connectors are not touching. Torque to 10–15 lbs. in. (1.1–1.7 N•m).
7. Before sealing wires in place, check sensor continuity by measuring the resistance between pins on the outside of the connector. Resistance between connector pins should be 1125 to 1375 ohms.
8. Check wire routing. Make sure wire is seated in the cast-in channel and will not get pinched when the head is reassembled to the housing. Seal wire in place with RTV.

To replace sensor on the short arm (flanged half) side, repeat previous steps. Since connector location is inside the mounting surface, there is less concern for pinching of the shorter 4 inch connector wires. However, before final assembly, check wire position and routing to make sure that it is not crimped or pinched.

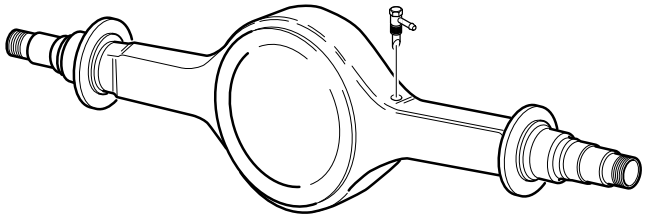


1—Installed position of axle shaft
2—Sensor terminals positioned near connector hole
3—Axle housing
4—4 inch long wires
5—Connector hole is not on carrier mounting surface
6—Axle carrier

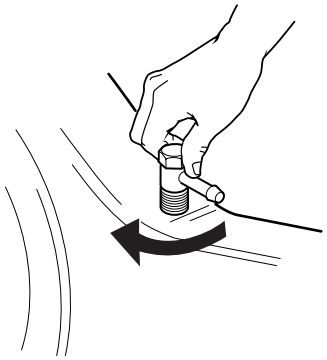
Install New Axle Housing Breather (Metal and Plastic)

Spicer Truck Components has released a new axle housing breather kit, part number 507162. This kit contains a fitting, hose and clamp assembly, and instructions. This new breather kit will replace the current breather (P/N 809560) and snap cap (P/N 126980) on the models listed above for both production and service. This newly designed breather has improved resistance to water ingestion, clogging caused by dirt, ice or snow buildup around the base of the breather. See installation instructions below (all views from rear).

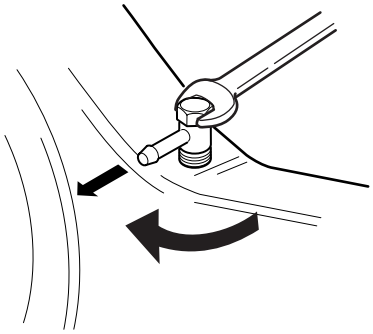
1. Install fitting in breather hole.



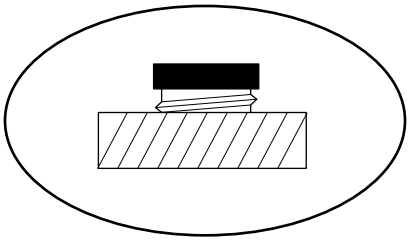
2. Tighten fitting finger tight.



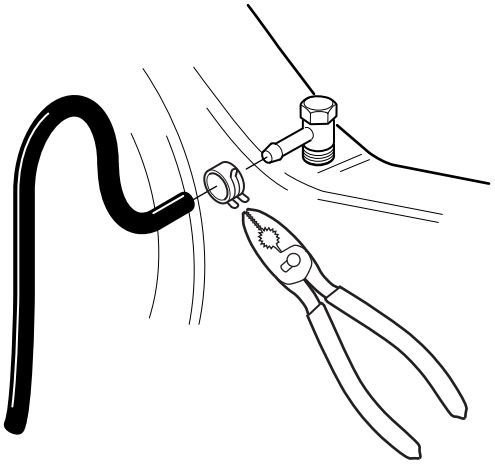
3. Using a 3/4” wrench:
4. **Metal only:** rotate the fitting at least 1/2 turn until nipple points to rear.



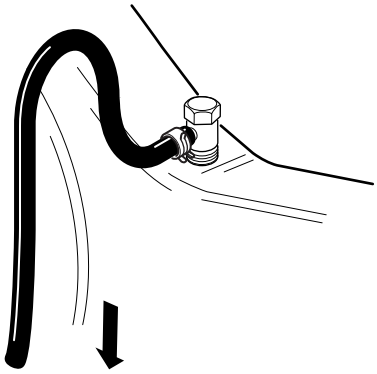
5. **Plastic only:** tighten until one thread is showing.



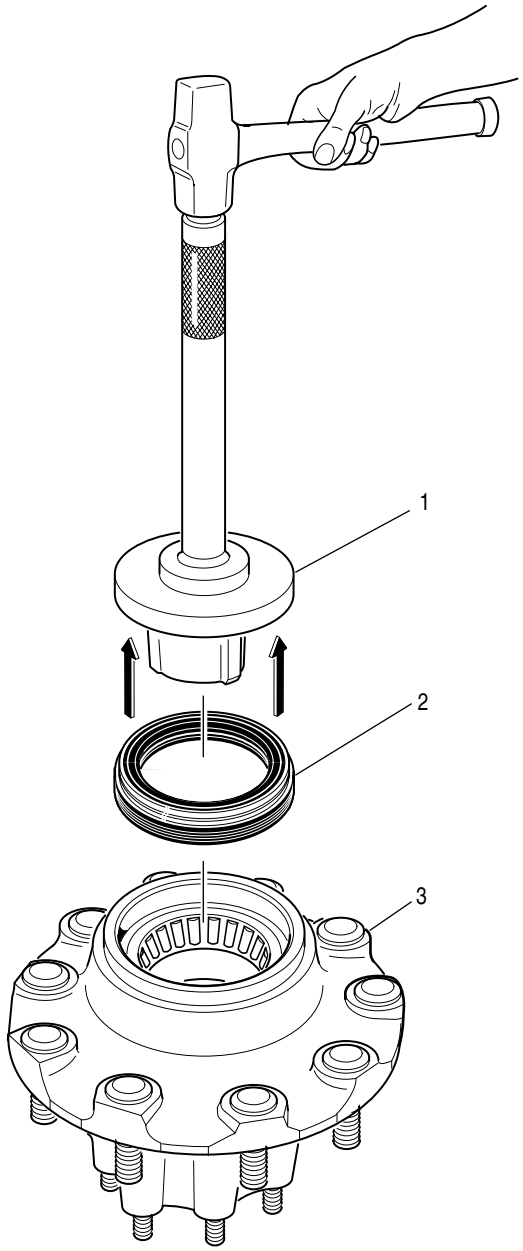
6. Insert hose onto fitting, long end down.



7. Push hose firmly against fitting. Rotate hose to point down.



Wheel End Seal - Parts Exploded View



1—Installation tool
2—Seal
3—Rear hub

Remove and Overhaul Wheel End Seal

⚠ WARNING

Never work under a vehicle supported by only a jack. Always support vehicle with stands. Block the wheels and make sure the vehicle will not roll before releasing the brakes.

⚠ IMPORTANT

Wheel end seals can be easily damaged during handling. Leave the seal in its package until installation to prevent damage or contamination.

1. Remove outer bearing and wheel.
2. Remove oil seal.
3. Remove inner bearing.
4. Remove old wear sleeve (2-piece design only) with a ball peen hammer and discard.

⚠ CAUTION

Do not cut through the old wear sleeve. Damage to the housing may result.

5. Inspect spindle journal and hub bore for scratches or burrs. Recondition with an emery cloth as required.

Note: Deep gouges can be repaired by filling gouge with hardening gasket cement and smoothing with emery cloth.

6. Clean hub cavity and bearing bores before reassembly. Be sure to remove contaminants from all recesses and corners.
7. Clean bearings thoroughly with solvent and examine for damage. Replace damaged or worn bearings.

⚠ IMPORTANT

Always use the seal installation tool specified by the seal manufacturer. Using an improper tool can distort or damage the seal and cause premature seal failure.

Install Wheel End Seal

1. Before installation, lubricate the following with the same lubricant used in the axle sump.
   - Inner bearing
   - Wheel seal (follow the directions provided by the seal supplier)
2. Place seal on installation tool.
3. Drive seal with installation tool onto hub.

Adjust Wheel Bearing

⚠ WARNING

Do not mix spindle nuts and lock washers from different systems. Mixing spindle nuts and lock washers can cause wheel separation.

Note: The lock washer for a four-piece tang/dowel-type wheel nut system is thinner than the lock washer for a three-piece tang-type wheel nut system and is not designed to bear against the inner nut.

1. Inspect the spindle and nut threads for corrosion and clean thoroughly or replace as required.

Note: Proper assembly and adjustment is not possible if the spindle or nut threads are corroded.

2. Inspect the tang-type washer (if used). Replace the washer if the tangs are broken, cracked, or damaged.
3. Install the hub and drum on the spindle with care to prevent damage or distortion to the wheel seal.

⚠ CAUTION

A wheel dolly is recommended during installation to make sure that the wheel seal is not damaged by the weight of the hub and drum. Never support the hub on the spindle with just the inner bearing and seal. This can damage the seal and cause premature failure.

4. Completely fill the hub cavity between the inner and outer bearing races with the same lubricant used in the axle sump.
5. Before installation, lubricate the outer bearing with the same lubricant used in the axle sump.

Note: Lubricate only with clean axle lubricant of the same type used in the axle sump. Do not pack the bearings with grease before installation. Grease will prevent the proper circulation of axle lubricant and may cause wheel seal failure.

6. Install the outer bearing on the spindle.
7. Install the inner nut on the spindle. Tighten the inner nut to 200 lbs. ft. (271 N•m) while rotating the wheel hub.

⚠ CAUTION

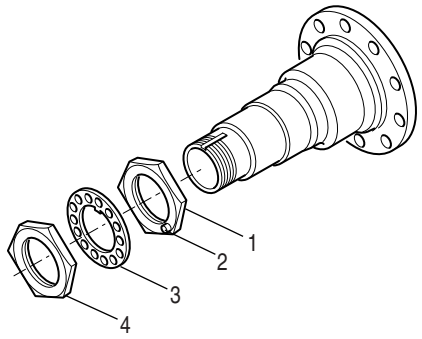
Never use an impact wrench to adjust wheel bearings. A torque wrench is required to assure that the nuts are properly tightened.

8. Back off the inner nut one full turn. Rotate the wheel hub.
9. Retighten the inner nut to 50 lbs. ft. (68 N•m) while rotating the wheel hub.
10. Back off the inner nut exactly 1/4 turn.

Note: This adjustment procedure allows the wheel to rotate freely with 0.001"–0.005" (0.025 mm–0.127 mm) end-play.

11. Install the correct lock washer for the wheel nut system being used.

Three-piece Dowel-type Lock Washer System



1—Inner nut (P/N 119882)
2—Dowel pin
3—Dowel-type lock washer (P/N 119883)
4—Outer nut (P/N 119881)

a. Install the Dowel-type lock washer on the spindle.

Note: If the dowel pin and washer are not aligned, remove washer, turn it over and reinstall. If required, loosen the inner nut just enough for alignment.

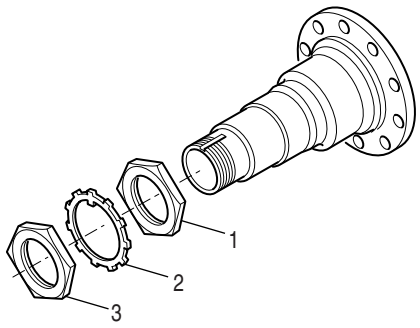
⚠ IMPORTANT

Never tighten the inner nut for alignment. This can preload the bearing and cause premature failure.

b. Install the outer nut on the spindle and tighten to 350 lbs. ft. (475 N•m).

c. Verify end-play, see page 81.

Three-piece Tang-type Lock Washer System



1—Inner nut (P/N 11249)
2—Tang-type lock washer (P/N 11245) .123" thick
3—Outer nut (P/N 11249)

a. Install the Tang-type lock washer on the spindle.

⚠ IMPORTANT

Never tighten the inner nut for alignment. This can preload the bearing and cause premature failure.

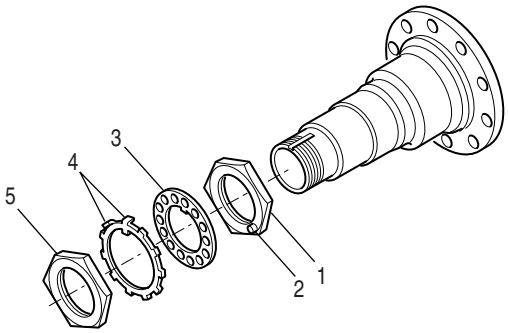
b. Install the outer nut on the spindle and tighten to 250 lbs. ft. (339 N•m).

c. Verify end-play, see page 81.

d. After verifying end-play, secure wheel nuts by bending one of the locking washer tangs over the outer wheel nut and another tang over the inner wheel nut.

e. Go to step 12.

Four-piece Tang/Dowel-type Lock Washer System



1—Inner nut (P/N 119882)
2—Dowel pin
3—Dowel-type lock washer (P/N 119883)
4—Tang-type lock washer (P/N 129132) .0478" thick
5—Outer nut (P/N 119881)

a. Install the Dowel-type lock washer on the spindle.

Note: If the dowel pin and washer are not aligned, remove washer, turn it over and reinstall. If required, loosen the inner nut just enough for alignment.

⚠ IMPORTANT

Never tighten the inner nut for alignment. This can preload the bearing and cause premature failure.

b. Install the Tang-type lock washer on the spindle.

c. Install the outer nut on the spindle and tighten to 250 lbs. ft. (339 N•m).

d. Verify end-play, see page 81.

e. After verifying end-play, secure the outer nut by bending (180° apart) two opposing tangs of the locking washer over the outer nut.

12. Install the following:
    - New gasket at axle shaft flange.
    - Axle shaft.
    - Axle flange nuts and tighten to specified torque.
13. Lubricate axle wheel ends.

Verify Wheel End-play Procedure

Verify that end-play meets specification using a dial indicator. An indicator with 0.001" (0.03 mm) resolution is required. Wheel end play is the free movement of the tire and wheel assembly along the spindle axis.

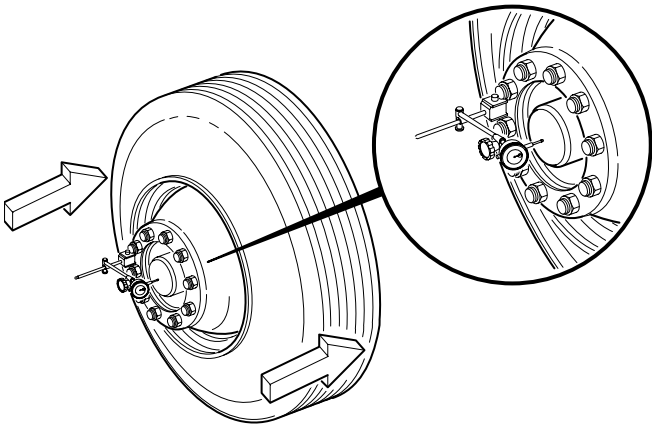
Correct end-play is .001"–.005" (0.025–0.125 mm).

1. Attach a dial indicator with its magnetic base to the hub or brake drum as shown below:
2. Adjust the dial indicator so that its plunger or pointer is against the end of the spindle with its line of action approximately parallel to the axis of the spindle.
3. Grasp the wheel assembly at the 3 o'clock and 9 o'clock positions. Push the wheel assembly in and out while oscillating it to seat the bearings. Read bearing end-play as the total indicator movement.

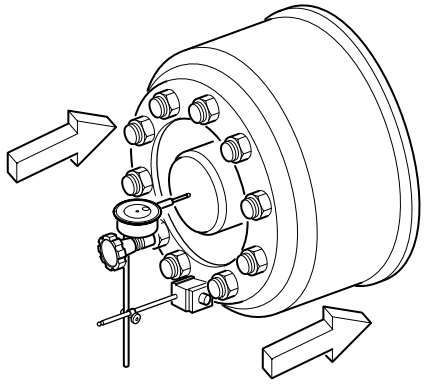
⚠ CAUTION

If end-play is not within specification, readjustment is required.

Adjust End-play with Tire and Wheel Assembly



Adjust End-play with Wheel Hub



With indicator mounted at bottom,
Push / Pull at sides of drum

Readjust Wheel End-play Procedure

Excessive End-play—If end-play is greater than .005" (.127 mm), remove the outer nut and pull the lock washer away from the inner nut, but not off the spindle. Tighten the inner nut to the next alignment hole of the dowel-type washer (if used). Reassemble the washer and re-torque the outer nut. Verify end-play with a dial indicator.

Insufficient End-play—If end-play is not present, remove the outer nut and pull the lock washer away from the inner nut, but not off the spindle. Loosen the inner nut to the next adjustment hole of the dowel-type washer (if used). Reassemble the washer and re-torque the outer nut. Verify end-play with a dial indicator.

Fine Tuning the End-play—If, after performing the readjustment procedures, end-play is still not within the .001"–.005" (.025–.127 mm) range, disassemble and inspect the components. If parts are found to be defective, replace the defective parts, reassemble and repeat wheel bearing adjustment procedure. Verify end-play with a dial indicator.

Lubricate Wheel End

⚠ IMPORTANT

Before operating the axle, the wheel hub cavities and bearings must be lubricated to prevent failure.

When wheel ends are serviced, follow Spicer's wheel end lubrication procedure before operating the axle.

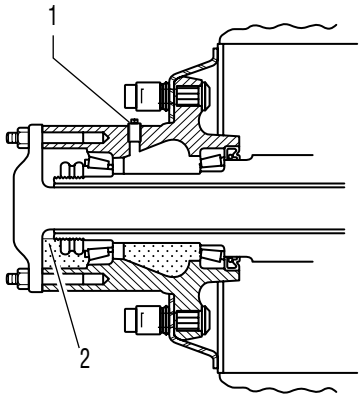
Spicer axles may be equipped with either of two wheel end designs:

- Wheel ends **with** an oil fill hole.
- Wheel ends **without** an oil fill hole.

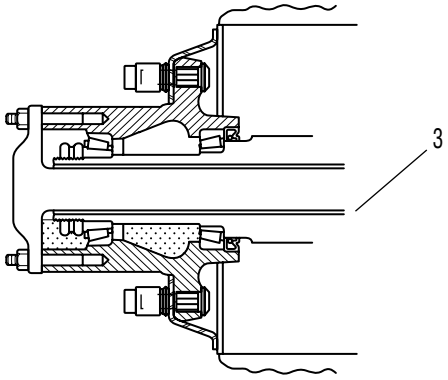
Wheel Ends with an Oil Fill Hole

1. Rotate the wheel end hub until the oil fill hole is up.
2. Remove the oil fill plug.
3. Pour 1/2 pint of axle sump lubricant into each hub through the wheel end fill hole.
4. Install oil fill plug and tighten to specified torque.

Wheel End with Oil Fill Hole



Wheel End without Oil Fill Hole

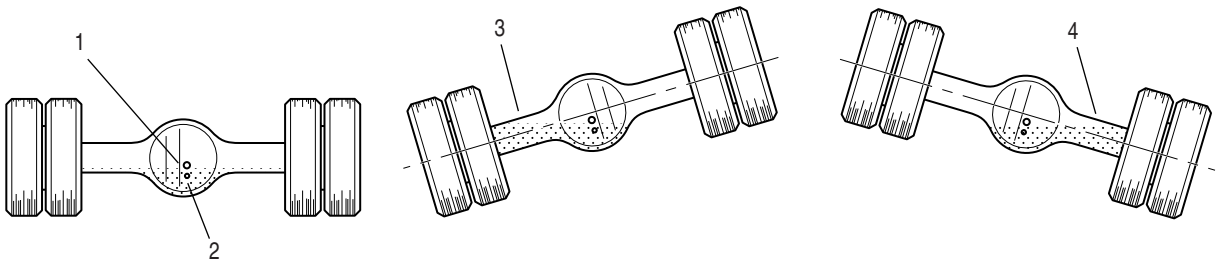


1—Wheel end oil fill hole
2—Proper lubricant level
3—Lubricant flow from sump

Wheel Ends Without Oil Fill Hole

1. With axle level and wheel ends assembled, add lubricant through filler hole in axle housing cover until fluid is level with the bottom of filler hole.
2. Raise the right side of the axle 6 inches or more. Hold axle in this position for one minute.
3. Lower the right side.
4. Raise the left side of the axle 6 inches or more. Hold axle in this position for one minute.
5. Lower the left side.
6. With axle on a level surface, add lubricant through housing cover oil filler hole until fluid is level with the bottom of the hole.

Note: Axles without wheel end fill holes will require approximately 2.5 additional pints of lubricant to bring the lube level even with the bottom of fill hole.



1—With axle on level surface, fill housing with oil to bottom of plug
2—Temperature sensor mounting hole
3—Oil will run into wheel end
4—Oil will run into wheel end
5—Tilt housing side to side (1 minute per side).
6—Recheck oil level in axle.

General Lubrication Information

The ability of a drive axle to deliver quiet, trouble-free operation over a period of years is largely dependent upon the use of good quality gear lubrication in the correct quantity. The most satisfactory results can be obtained by following the directions contained in this manual.

The following lubrication instructions represent the most current recommendations from Dana.

Approved Lubricants

General— Gear lubrications acceptable under military specification (MILSPEC) MIL-L-2105D (Lubricating Oils, Gear, Multipurpose) are approved for use in Spicer Drive Axles. The MIL-L-2105D specification defines performance and viscosity requirements for multigrade oils. It supersedes both MIL-L-2105B, MIL-L-2105C and cold weather specification MIL-L-10324A. This specification applies to both petroleum-based and synthetic based gear lubricants if they appear on the most current "Qualified Products List" (QPL-2105) for MIL-L-2105D.

Note: The use of separate oil additives and/or friction modifiers are not approved in Spicer Drive Axles.

Synthetic based— Synthetic-based gear lubricants exhibit superior thermal and oxidation stability, and generally degrade at a lower rate when compared to petroleum-based lubricants. The performance characteristics of these lubricants include extended change intervals, improved fuel economy, better extreme temperature operation, reduced wear and cleaner component appearance. The family of Spicer gear lubricants represents a premium quality synthetic lube which fully meets or exceeds the requirements of MIL-L-2105D. These products, available in both 75W-90 and 80/W-140, have demonstrated superior performance in comparison to others qualified under the MILSPEC, as demonstrated by extensive laboratory and field testing. For a complete list of Spicer approved synthetic lubricants contact your local Dana representative. See back cover of this manual for appropriate phone number.

Makeup Lube— Maximum amount of non-synthetic makeup lube is 10%.

Recommendations for Viscosity/Ambient Temperature

The following chart lists the various SAE Grades covered by MIL-L-2105D and the associated ambient temperature range from each. Those SAE grades shown with an asterisk (*) are available in the Spicer family of synthetic gear lubricants.

The lowest ambient temperatures covered by this chart are -40°F and -40°C. Lubrication recommendations for those applications which consistently operate below this temperature range, must be obtained through Dana by contacting your local Dana Spicer representative.

Grade	Ambient Temperature Range
75W	-40°F to -15°F (-40°C to -26°C)
75W-80	-40°F to 80°F (-40°C to 21°C)
75W-90*	-40°F to 100°F (-40°C to 38°C)
75W-140	-40°F and above (-40°C and above)
80W-90	-15°F to 100°F (-26°C to 38°C)
80W-140*	-15°F and above (-26°C and above)
85W-140	10°F and above (-12°C and above)

* Available in the Spicer family of synthetic gear lubricants

Lube Change Intervals

This product combines the latest manufacturing and part washing technology. **When filled with a Spicer approved synthetic lubricant at the factory, the initial drain is not required.**

Change the lubricant within the first 5,000 miles of operation when not using a Spicer approved synthetic lubricant in either a new axle or after a carrier head replacement. Base subsequent lubricant changes on a combination of the following chart and user assessment of the application and operating environment.

Severe Service Lubrication Change Intervals—Severe service applications are those where the vehicle consistently operates at or near its maximum GCW or GVW ratings, dusty or wet environments, or consistent operation on grades greater than 8%. For these applications, the ON/OFF HIGHWAY portion of the chart should be used. Typical applications are construction, logging, mining and refuse removal.

Note: Clean metallic particles from the magnetic filler plug and drain plugs. Clean or replace the breather yearly to avoid lube contamination due to water ingestion.

Synthetic or Mineral	Lubricant	SAE	Change Interval for Line Haul	Change Interval for Vocational
Synthetic*	SHAES-256	SAE 75W-90	500,000 miles [800,000 Km] or 5 years	120,000 miles (193,000 Km) or 1year
Synthetic**	SHAES-256	SAE 75W-90, 75W-140	250,000 miles (400,000 Km) or 3 years	60,000 miles [96,500 Km] or 1 year
Mineral Base	MIL-L-2105E/J02360, API GL-5 Gear Oil, MIL-PRF-2105E	75W, 75W-90, 75W-140, 80W-90, 85W-140	120,000 miles [193,000 Km] or 1 year	60,000 miles [96,500 Km] or 1 year

* Axles using LMS wheel end system

** Axles using adjustable wheel bearing system

Change Lube

Drain

Drain when the lube is at normal operating temperature (150°–200°F). It will run freely and minimize the time necessary to fully drain the axle, this insures the axle is flushed.

Unscrew the magnetic drain plug on the underside of the axle housing and allow the lube to drain into a suitable container.

Note: Dispose of all used lubricants properly by following disposal methods approved for mineral or synthetic based oils.

After initial oil change, inspect drain plug for large quantities of metal particles. These are signs of damage or extreme wear in the axle. Clean the drain plug and replace it after the lube has drained completely. Inspect breather for clogging or corrosion. Clean or replace as necessary.

Fill

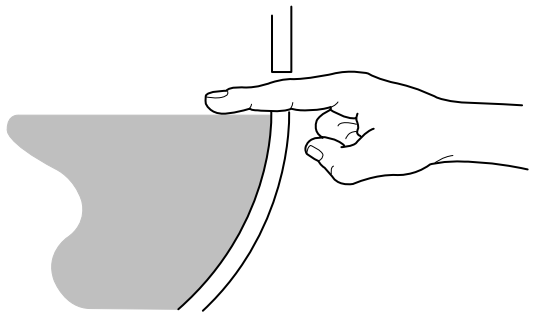
Front Axle

a. With vehicle on level ground, remove the filler hole plug from the axle housing cover and fill the axle with approved lubricant until level with the bottom of the hole.

Rear Axle

a. Remove the filler hole plug from the axle housing cover and fill the axle with the approved lubricant until level with the bottom of the hole.

b. If wheel ends were removed, follow instructions in wheel end servicing pages 81–83.

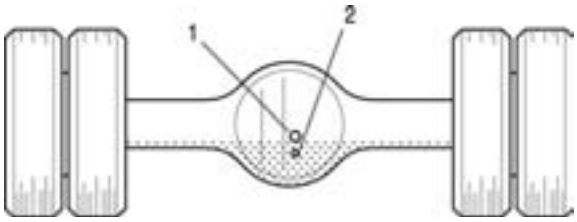


Correct lube level at bottom of filler hole.

Always use the filler hole as the final reference. If lube is level with the bottom of the hole, the axle is properly filled.

Note: Lube fill capacities (see chart) are basic guidelines and will vary based on the angle the axle is installed in a particular chassis. Torque fill plug to 40–60 lbs. ft. (54–82 N•m).

TIP: The axle can be filled through the axle housing breather hole. Fill until lube level is even with the bottom of filler hole in axle housing rear cover.



1 - With axle on level surface, fill housing with oil to bottom of plug.
2 - Temperature sensor mounting hole.

Standpipes

Drive axles are lubricated with oil drawn from a large sump integral to the assembly. Most axle designs attempt to position vital components such as pinion bearings in close proximity to this sump, keeping them bathed in a generous supply of oil at all times.

When drive axles are installed at severe angles in vehicle chassis, the position of these components is changed relative to the oil sump. The same effect is present when the vehicle travels up a steep grade. Oil in the sump remains level while the axle itself tilts up or down. This makes it possible for bearings and gears located well forward in the assembly to "starve" for lubrication even though the axle is filled to the base of the fill plug hole as recommended by the manufacturer.

Axles should be modified with standpipes to raise lube levels whenever chassis installation angles exceed 10° and when the vehicle must negotiate continuous or lengthy grades on a routine basis.

The chart gives standpipe recommendations for vehicles operating in consistently mountainous areas.

Axle Installation Angle	Axle Location	Quantity (pints)
12°	Rear	19*
10°	Rear	21*
8°	Rear	22.5*
6°	Forward	24.5
6°	Rear	25
4°	Forward	27
4°	Rear	25
2°	Forward	29
2°	Rear	26
0°	Forward	31
0°	Rear	28

*Does not allow for standpipe.

Capacities do not include wheel equipment requirements. An additional 1–2 pints is required in each wheel hub.

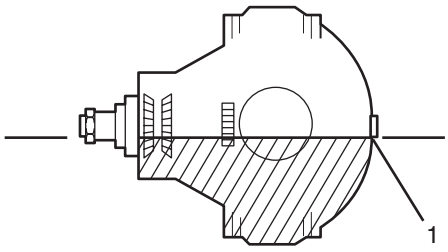
Tandem Forward Axles			
Installation Angle*	5-10% Grade	10-15% Grade	15-20% Grade
0°	–	–	–
3°	–	–	2.00"
5°	–	1.00"	2.25"
7°	–	1.25"	2.50"
10°	1.50"	1.75"	2.75"
13°	1.75"	2.00"	3.00"
15°	2.50"	2.50"	3.25"

*Pinion pointing upward

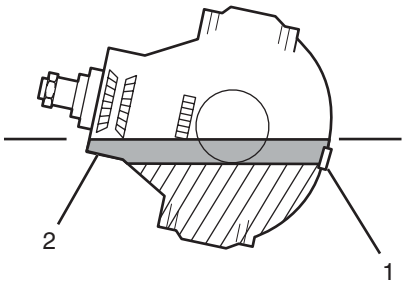
Tandem Rear Axles			
Installation Angle*	5-10% Grade	10-15% Grade	15-20% Grade
0°	–	–	–
3°	–	–	1.00"
5°	–	1.00"	1.75"
7°	–	1.75"	2.00"
10°	–	2.00"	2.25"
13°	1.00"	2.25"	2.75"
15°	2.00"	2.50"	3.25"

*Pinion pointing upward

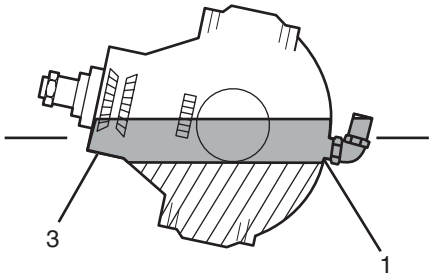
Horizontal Mounting



12° Installation



12° Installation with Standpipe



1—Oil filler hole
2—Lost oil capacity
3—Additional oil capacity

Note: Grades must be continuous or lengthy in nature. Monitor oil temperatures before installing standpipes. Axles should operate at approximately 100°F (38°C) over ambient temperature and not exceed 240°F (116°C).

Final Check

Prior to putting vehicle back into service, run the vehicle to bring axle lube up to temperature. Check filler and drain plugs and axle joint for leakage. Re-tighten to specifications as necessary.

Proper Vehicle Towing

Without Wheel Differential Lock

Lift the drive wheels completely off of the ground or damage will occur.

⚠ WARNING

Do not lift the front wheels (non-drive wheels). This alters the oil's position in the drive axle, draining it away from the drive pinion and its bearings. If the pinion is rotated under these conditions for any period of time, bearings will overheat resulting in axle damage or failure.

If this is impossible to lift the drive wheels, remove all axle shafts to prevent gear rotation and cap the wheel hubs to prevent loss of lubricant and a possible road hazard. See the following section Proper Vehicle Towing with Wheel Differential Lock for removal procedure.

With Wheel Differential Lock

Follow this procedure to remove all axle shafts preventing gear rotation with the drive wheels and possible lubrication damage.

1. Engage the wheel differential lock, indicator light is on (move vehicle to verify engagement).
2. Shift transmission into neutral.
3. With vehicle stationary, release the air pressure on the wheel differential lock shift system and apply the parking brake.
4. Disconnect the air supply and fitting at the shift cylinder.
5. Install the shipping capscrew 128642 (.250 X 18 X 1.5") NPSM screw. GM models require part number 128274 (M12 X 1.5 X 38mm) screw. Tighten capscrew to manually engage the wheel differential lock until the indicator light is on and the differential lock is completely engaged.
6. Remove the axle shafts.
7. Install temporary cover on hub to prevent contamination entering and also to prevent the loss of lubricant.

Power Divider Operation (Power Flow and Torque Distribution)

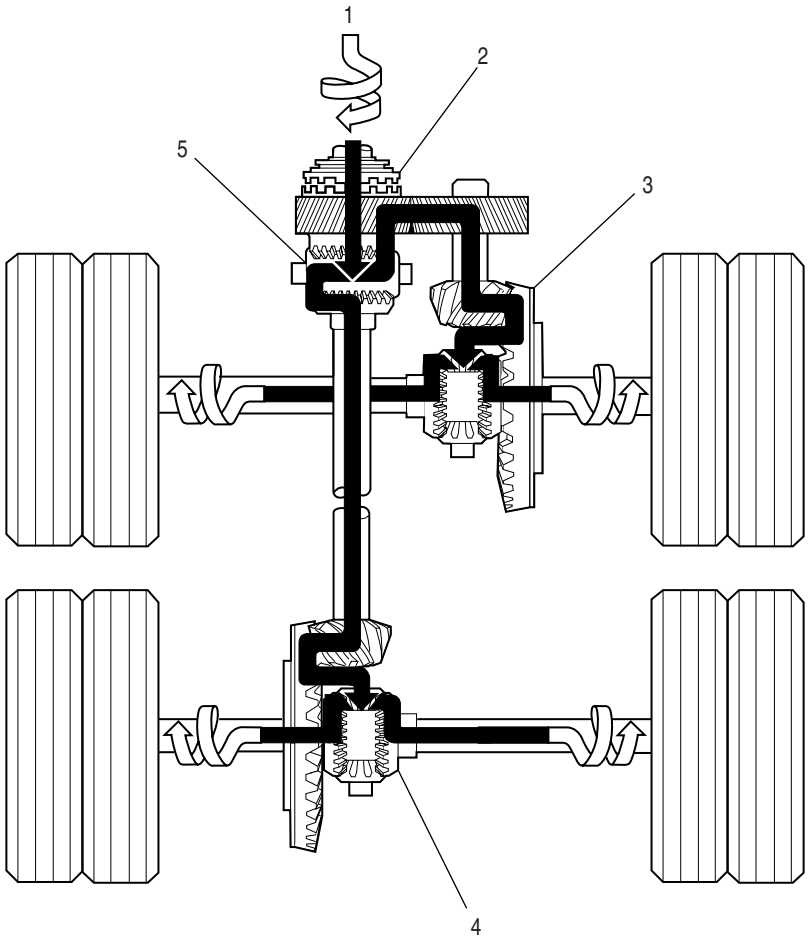
In operation, the power divider accepts torque from the vehicle driveline and distributes it equally to the two axles.

This assembly is of the two-gear design consisting of an input shaft, inter-axle differential, output shaft and two constant-mesh helical gears.

The inter-axle differential compensates for minor variations in speed between the two axles, the same way the wheel differential works between the two wheels of a single drive axle. This unit also acts as a central point in distribution of torque to the two axles.

The power divider also includes a driver-controlled, air-operated lockout. When lockout is engaged, it mechanically prevents inter-axle differentiation for better performance under poor traction conditions.

With Lockout Engaged
(Inter-Axle Differential is Operating)



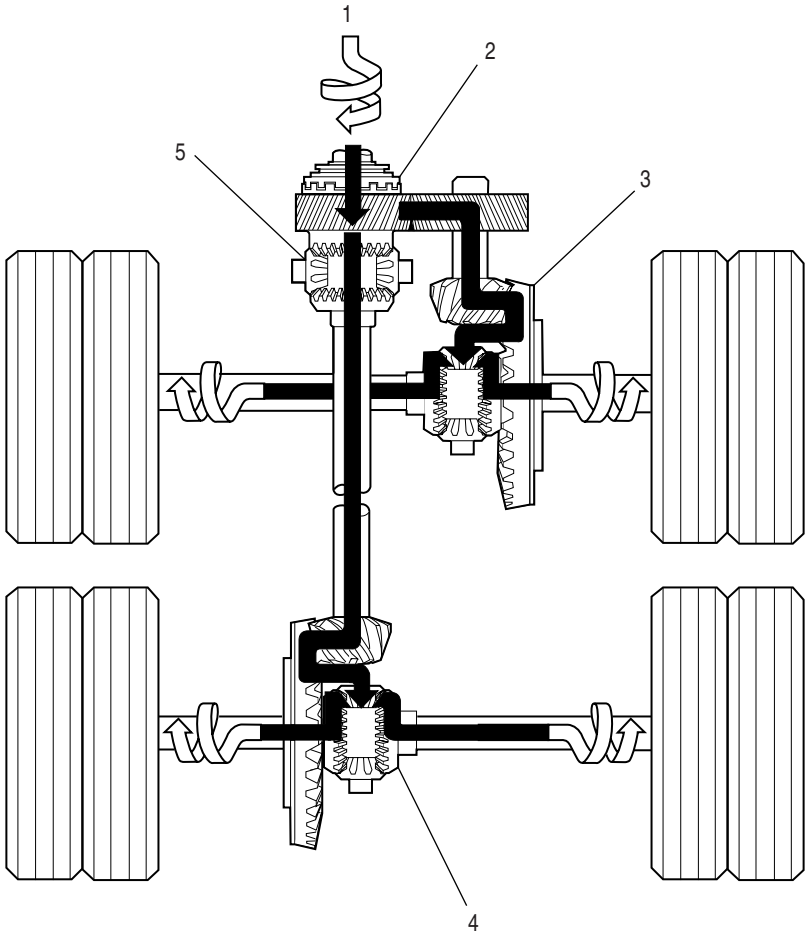
1— Input torque
2— Lockout disengaged
3— Forward axle torque is transmitted from the helical side gear through the pinion helical gear, drive pinion, ring gear, wheel differential and axle shafts.
4— Rear axle torque is transmitted from the output shaft side gear through the output shaft, inter-axle driveline, drive pinion, ring gear, wheel differential and axle shafts.
5— Input torque (power flow) from the vehicle driveline is transmitted to the input shaft and the inter-axle differential spider. The differential distributes torque equally to both axles.

With Lockout Engaged
(Inter-Axle Differential is Not Operating)
Lockout should only be engaged when both axles are rotating at the same speed. Operation should be limited to low-traction situations and should be disengaged when normal traction returns. Failure to do so will result in poor handling and damage to the axle components.

Note: Varied road surface conditions can result in unequal torque distribution between the two axle assemblies.

⚠ CAUTION

Prolonged operation with the lockout engaged can damage axle and driveline components.



1— Input torque
2— Lockout engaged
3— Forward axle torque is transmitted from the helical side gear through the pinion helical gear, drive pinion, ring gear, wheel differential and axle shafts.
4— Rear axle torque is transmitted from the output shaft side gear through the output shaft, inter-axle driveline, drive pinion, ring gear, wheel differential and axle shafts.
5— Input torque (power flow) from the vehicle driveline is transmitted directly to the helical side gear and the output shaft. A positive drive is provided to both axles for maximum traction under adverse road conditions.

Operate Wheel Differential Assembly

The Spicer wheel differential lock is driver-controlled and operated by a carrier mounted air-actuated shift unit. In operation, it positively locks the wheel differential to provide improved traction under adverse road conditions.

Control Systems for Differential Lock

Two systems may be used to control the differential lock operation.

Transmission Low-Range Interlock Control System

The wheel differential is locked manually with the transmission in Low-Range. It is unlocked by the driver or unlocked when the transmission is shifted out of Low-Range.

Note: The interlock system is preferred for vehicles equipped with an air-shifted, Low-Range transmission. It is designed to ensure the differential lock is not left engaged (and to prevent accidental engagement) when transmission is in high range.

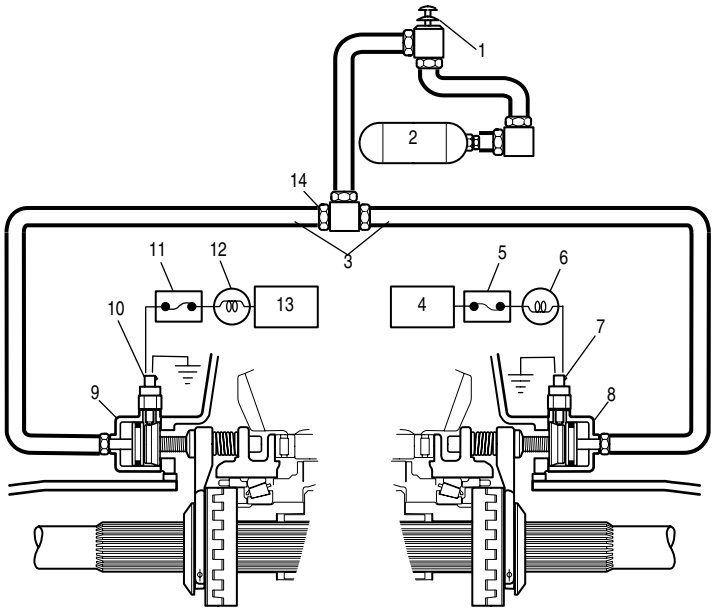
Direct Driver-controlled System

Direct Driver-controlled System

The driver manually locks and unlocks the wheel differential, using a cab-mounted electric switch (or air valve). The following description assumes the system includes a cab-mounted electric switch and a solenoid valve as shown in the illustration. An air valve may be substituted for these components.

Operation is as follows:

1. With control switch in the “unlock” position, the wheel differential functions normally.
2. When the control switch is placed in the “lock” position, the air supply solenoid valve opens and air pressure activates the shift cylinder. The shift fork is moved to engage the curvic clutches, which, in turn, lock the wheel differential.
3. When the control switch is placed in the “unlock” position, air pressure supply to the shift cylinder is shut off and air pressure is released from the cylinder. A compression spring moves the shift fork to disengage the curvic clutch and unlock the wheel differential.



1— Cab-mounted control valve (plunger in—valve open)
2— Dry air supply tank 80–120 PSI
3— Preferably equal in length
4— Power supply
5— Fuse or circuit breaker
6— Indicator light or audible signal
7— Wheel differential lock indicator switch (part of axle assembly)
8— Rear axle wheel differential lock air shift cylinder (part of axle assembly)
9— Forward rear axle wheel differential lock air shift cylinder (part of axle assembly)
10— Wheel differential lock indicator switch (part of axle assembly)
11— Indicator light of audible signal
12— Fuse or circuit breaker
13— Power supply
14— 66468 Quick release valve (optional) located on frame rail and within 10 feet of tubing from control valve

Wheel Differential Lock

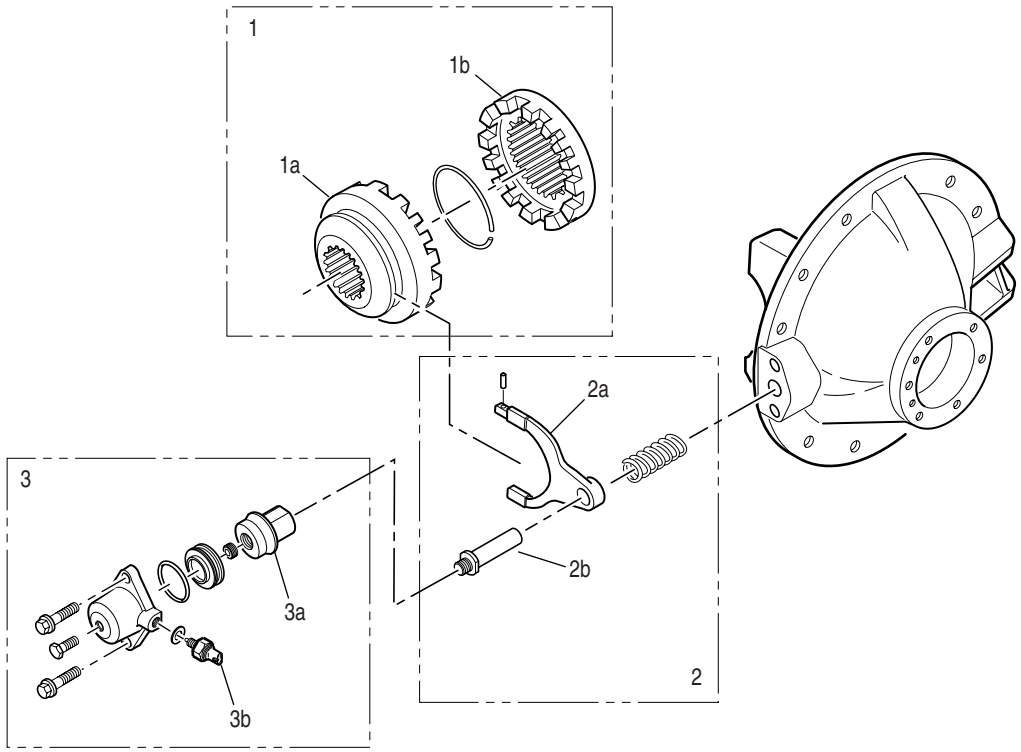
The Spicer Wheel Differential Lock is an optional feature for Spicer Axles. In operation, it positively locks the wheel differential, to provide improved traction under adverse road conditions.

The differential lock is driver-controlled through an electric switch or air valve mounted in the cab. The locking mechanism is air-operated to engage a mechanical clutch and lock the wheel differential. It is spring-operated to disengage the lock and permit the wheel differential to function normally.

The wheel differential lock consists of three major assemblies.

- **Shift Cylinder Assembly:** Operates a shift fork and push rod assembly.
- **Shift Fork and Push Rod Assembly:** Engages and disengages the differential lock curvic clutch assembly.
- **Curvic Clutch Assembly:** Consists of a sliding clutch splined to a axle shaft and a fixed clutch which is splined to the differential case hub.

The differential lock also includes a selector switch (electric) which senses clutch engagement and sends an electrical signal to a cab mounted indicator light (or an audible signal device).

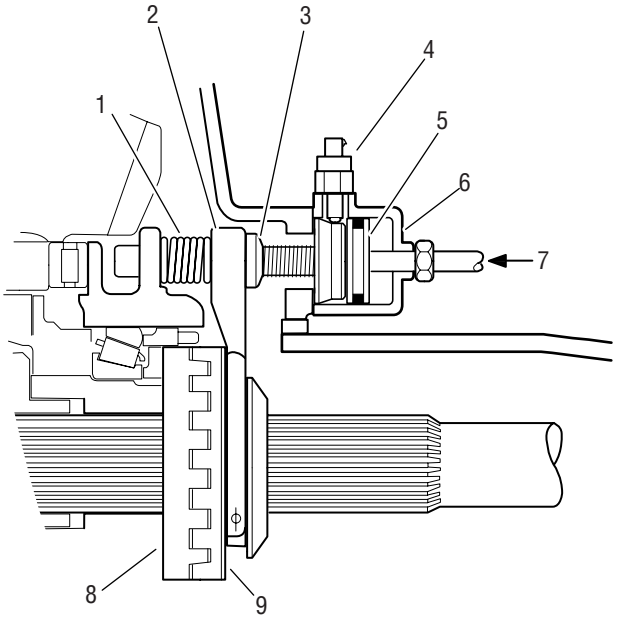


1— Curvic clutch assembly
1a—Sliding clutch
1b—Fixed clutch
2— Shift fork and push rod assembly
2a—Shift fork
2b—Pushrod
3— Shift cylinder assembly
3a—Piston driver
3b—Selector switch

Differential Lock Engaged
Air pressure applied to the shift cylinder moves the piston, push rod, shift fork and the sliding curvic clutch engages the fixed curvic clutch.

The sliding clutch is splined to the axle shaft. The fixed clutch is splined to the differential case hub. Engaging the two clutches locks the wheel differential thus preventing wheel differential action.

Differential Lock Disengaged
When air pressure at the shift cylinder is released, a compression spring (mounted on the push rod) moves the push rod, shift fork and sliding clutch as an assembly. The sliding clutch moves out of engagement with the fixed clutch. The wheel differential is unlocked and operates normally.

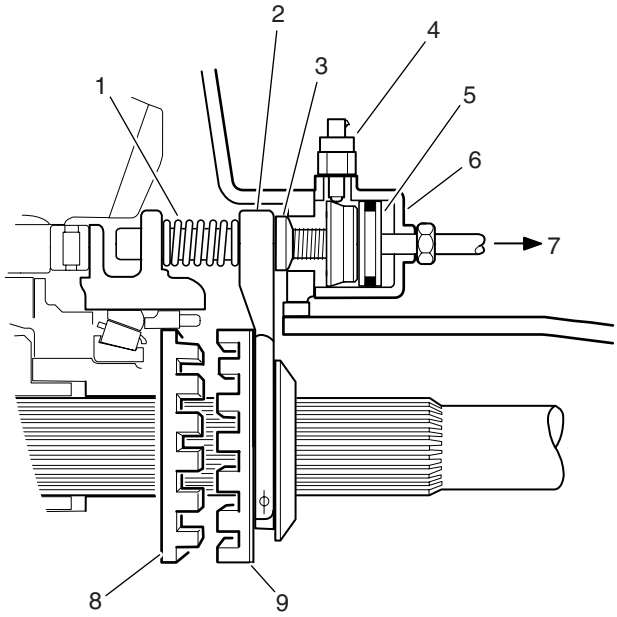


Differential Lock Engaged
1— Spring is compressed
2— Shift fork
3— Push rod
4— Selector switch
5— Piston
6— Shift cylinder
7— Air pressure applied engages clutches
8— Fixed clutch splined to differential case
9— Sliding clutch splined to axle shaft

Differential Lock Engagement Indicator
Differential lock engagement is detected by a switch (electric) mounted on the differential carrier. An actuator, mounted in the piston cover, operates the switch.

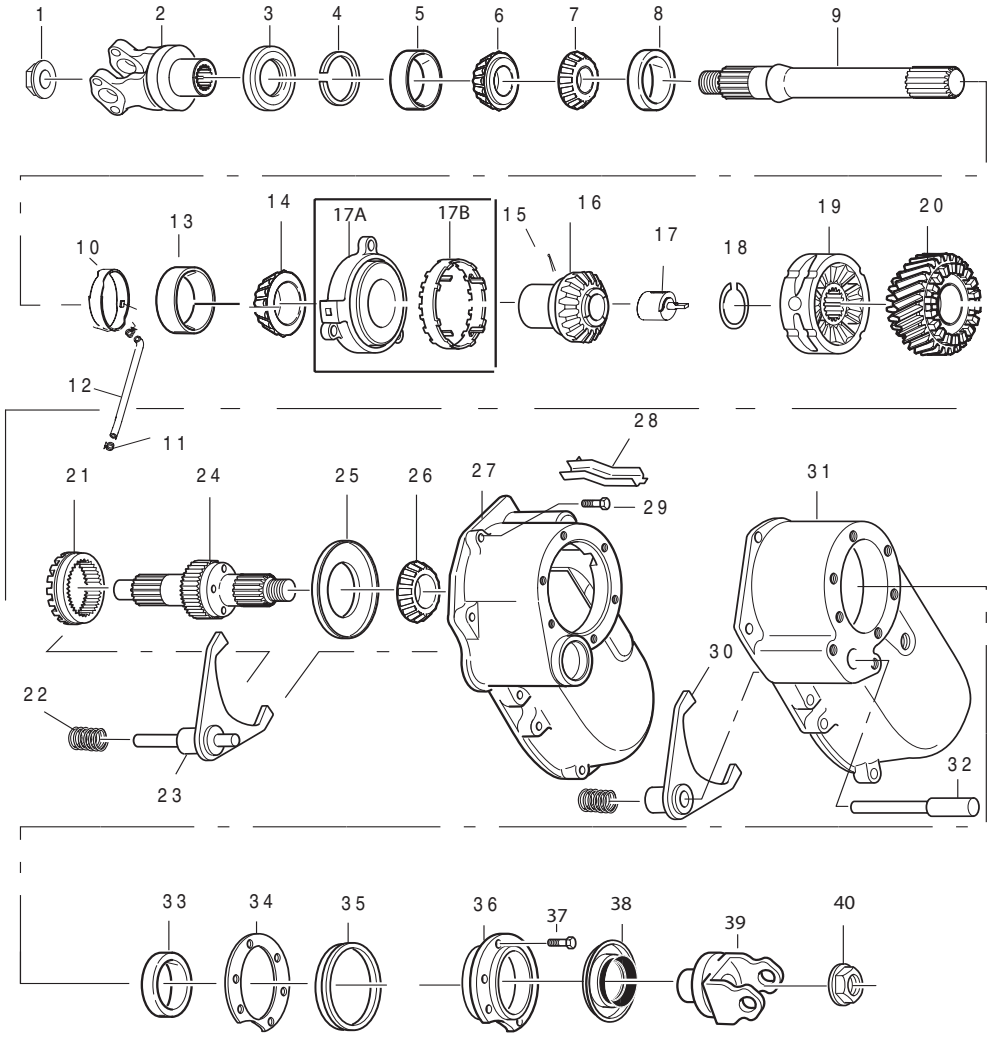
When the shift fork moves to engage the differential lock, the push rod actuator moves away from the switch, allows the switch to close and send an electrical signal to turn on a cab-mounted indicator light (or an audible signal).

When the shift fork moves to disengage the differential lock, the compression spring also moves the push rod actuator to contact the switch. The switch is opened and turns off the cab-mounted indicator light (or the audible signal).



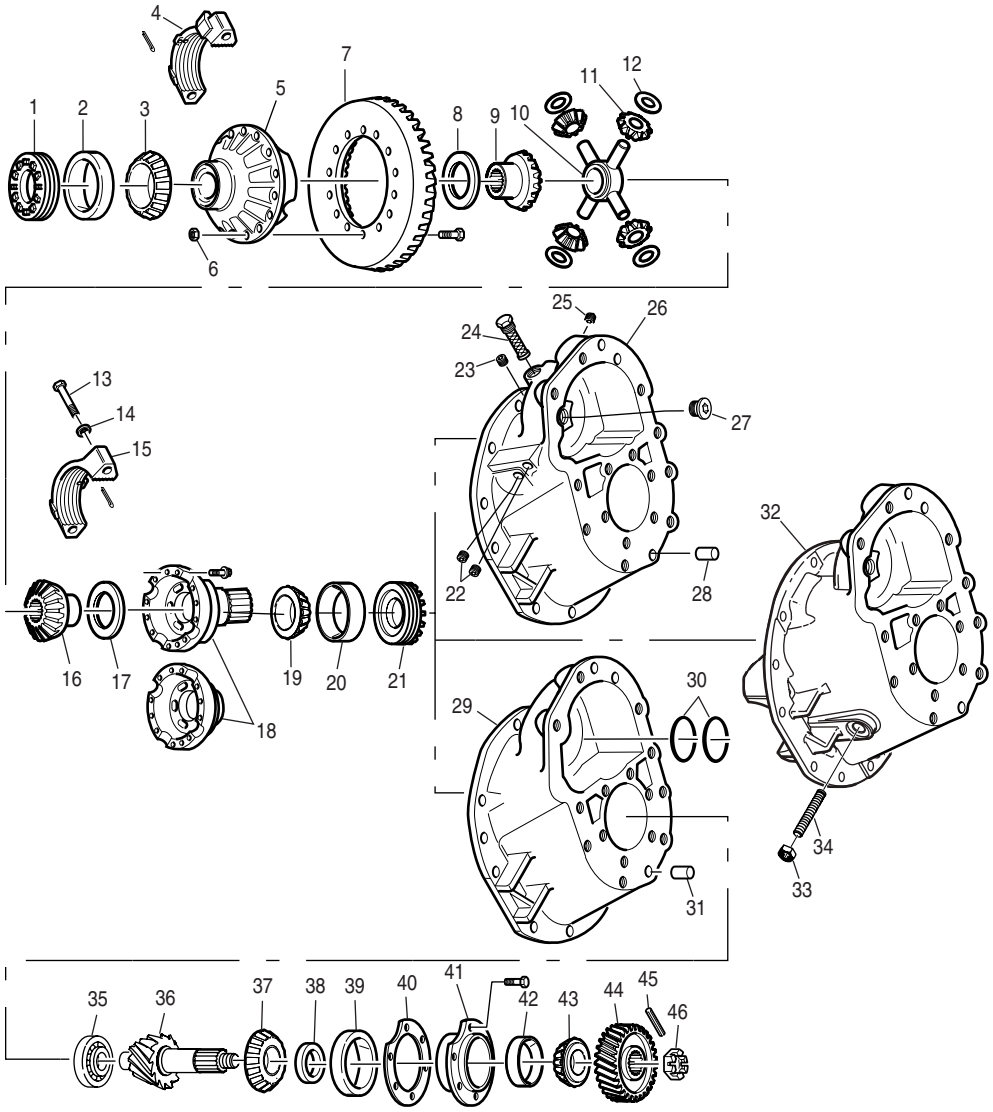
Differential Lock Disengaged
1— Spring is decompressed
2— Shift fork
3— Push rod
4— Selector switch
5— Piston
6— Shift cylinder
7— Air pressure applied disengages clutches
8— Fixed clutch splined to differential case
9— Sliding clutch splined to axle shaft

Power Divider - Parts Exploded View



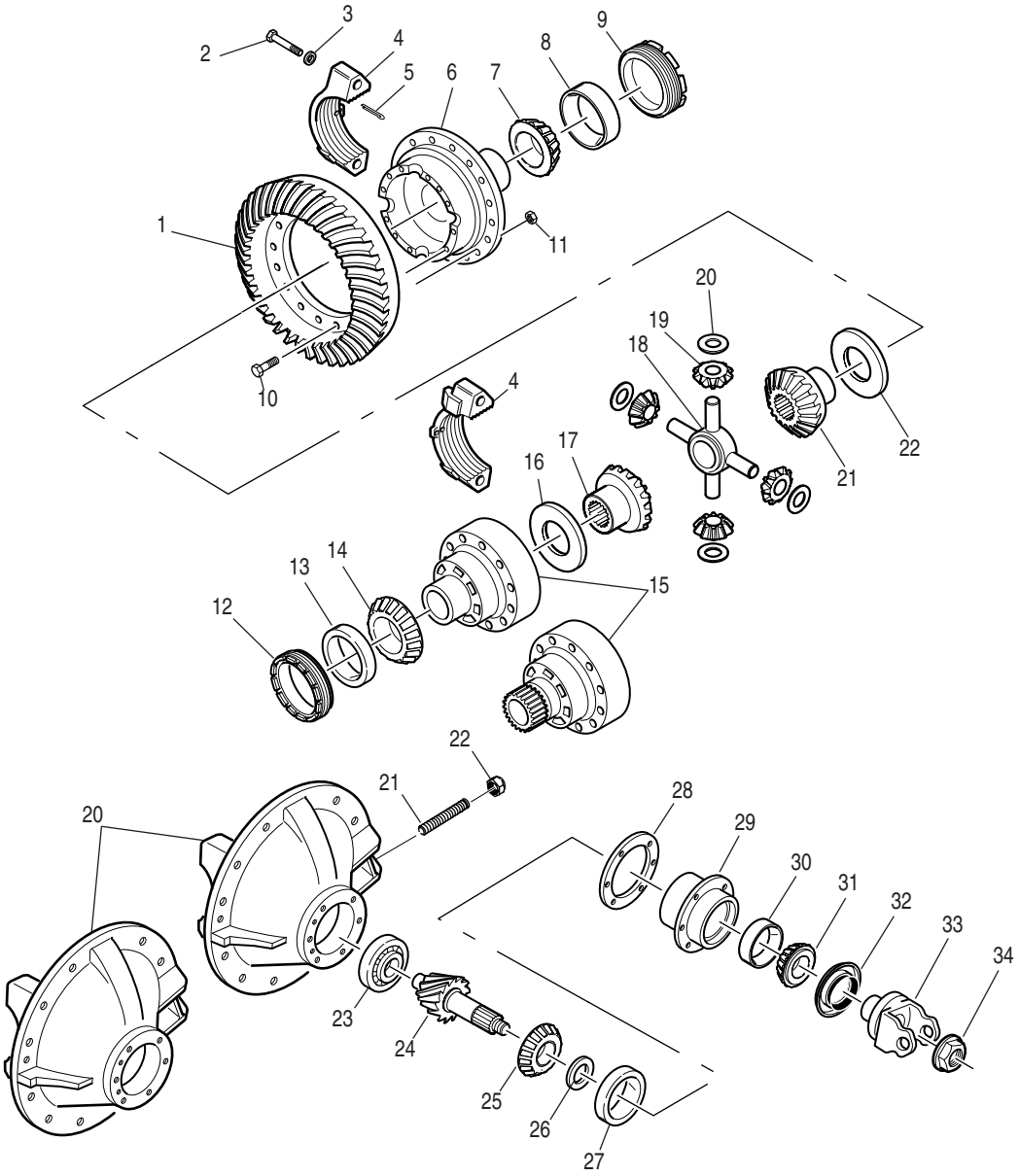
1 —Output shaft nut
2 —Output yoke
3 —Output seal
4 —Output shaft bearing snap ring
5 —Outer bearing cup
6 —Outer bearing cone
7 —Inner bearing cone
8 —Inner bearing cup
9 —Output shaft
10 —Seal manifold assembly
11 —Sump screen
12 —Seal manifold feed tube
13 —Output side gear bearing cup
14 —Output side gear bearing cone
15 —Pump locking Pin
16 —Output side gear
17 —Pump
17A ---Old style pump
17B—Output side gear bearing cup
18—Snapping ring
19 —Inter-axle differnential
20 —Helical side gear
21 —Sliding clutch
22 ---Push rod spring
23—Shift fork assembly
24 —Input shaft
25 —Input shaft oil retainer
26 —Input shaft bearing cone
27 —Power divider cover (integral)
28 —Lube trough
29 —Capscrew
30 ---Shift fork
31 —Power divider cover (Old style)
32 —Push rod
33 —Input bearing cup
34 —Input cage shim
35 —Input cage V-ring
36 —Input cage
37 —Capscrew
38 —Oil seal
39 —Input yoke
40 —Input nut

Front Drive Axle - Parts Exploded View



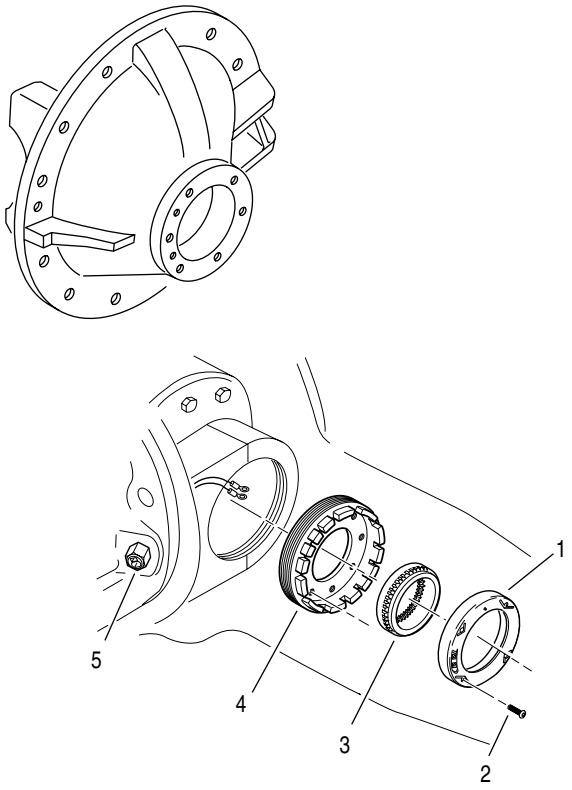
1— Flange half bearing adjuster
2— Flange half bearing cup
3— Flange half bearing cone
4— Flange half carrier cap
5— Flange half differential case
6— Nut
7— Ring gear
8— Side gear thrust washer
9— Side gear
10— Wheel differential spider
11— Side pinion
12— Side pinion thrust washer
13— Carrier cap bolt
14— Lock washer
15— Plain half carrier cap
16— Side gear
17— Side gear thrust washer
18— Plain half differential case
19— Plain half bearing cone
20— Plain half bearing cup
21— Plain half bearing adjuster
22— D-head carrier with pump
23— Core plugs
24— Pump filter
25— Core plugs
26— D-head carrier or front carrier with a pump
27— 1-inch core plug
28— Dowel
29— D-head carrier or front carrier
30— O-ring
31— Dowel
32— D-head carrier or front carrier with thrust bolt
33— Thrust bolt jam nut
34— Thrust bolt
35— Pinion pilot bearing
36— Pinion
37— Inner pinion bearing cone
38— Pinion bearing spacer
39— Inner pinion bearing cup
40— Pinion cage shim
41— Pinion cage
42— Outer pinion bearing cup
43— Outer pinion bearing cone
44— Helical gear
45— Pinion roll pin
46— Pinion nut

Rear Drive Axle - Parts Exploded View



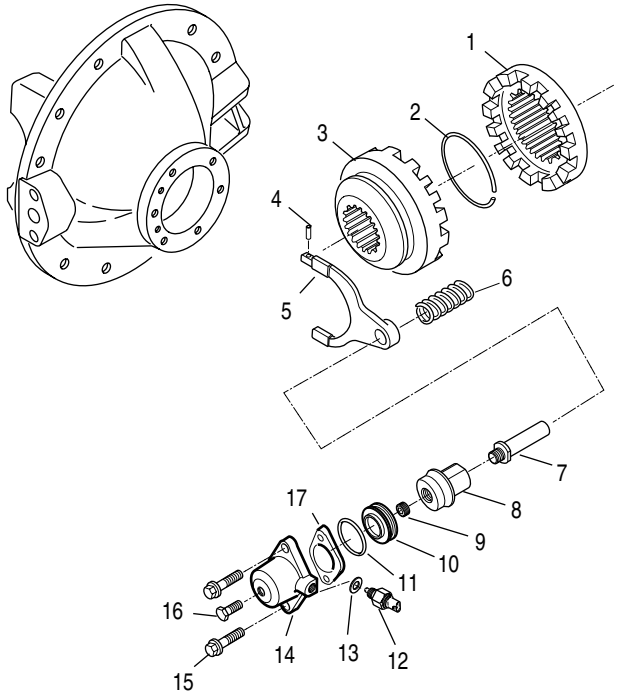
1— Ring gear
2— Carrier cap bolt
3— Flange half carrier cap
4— Flange half differential case
5— Flange half bearing cone
6— Flange half bearing cup
7— Flange half bearing adjuster
8— Plain half bearing adjuster
9— Plain half bearing cup
10— Plain half bearing cone
11— Plain half differential case
12— Side gear thrust washer
13— Plain half carrier cap
14— Side gear
15— Side pinion
16— Side pinion thrust washer
17— Wheel differential spider
18— Side gear
19— Side gear thrust washer
20— R-head carrier or rear carrier
21— Thrust bolt
22— Thrust bolt jam nut
23— Pinion pilot bearing
24— Pinion
25— Inner pinion bearing cone
26— Pinion bearing spacer
27— Inner pinion bearing cup
28— Pinion cage shim
29— Pinion cage
30— Outer pinion bearing cup
31— Outer pinion bearing cone
32— Pinion seal
33— Pinion yoke
34— Pinion nut
35— R-head carrier with thrust bolt

Inter-Axle Speed Sensor - Parts Exploded View



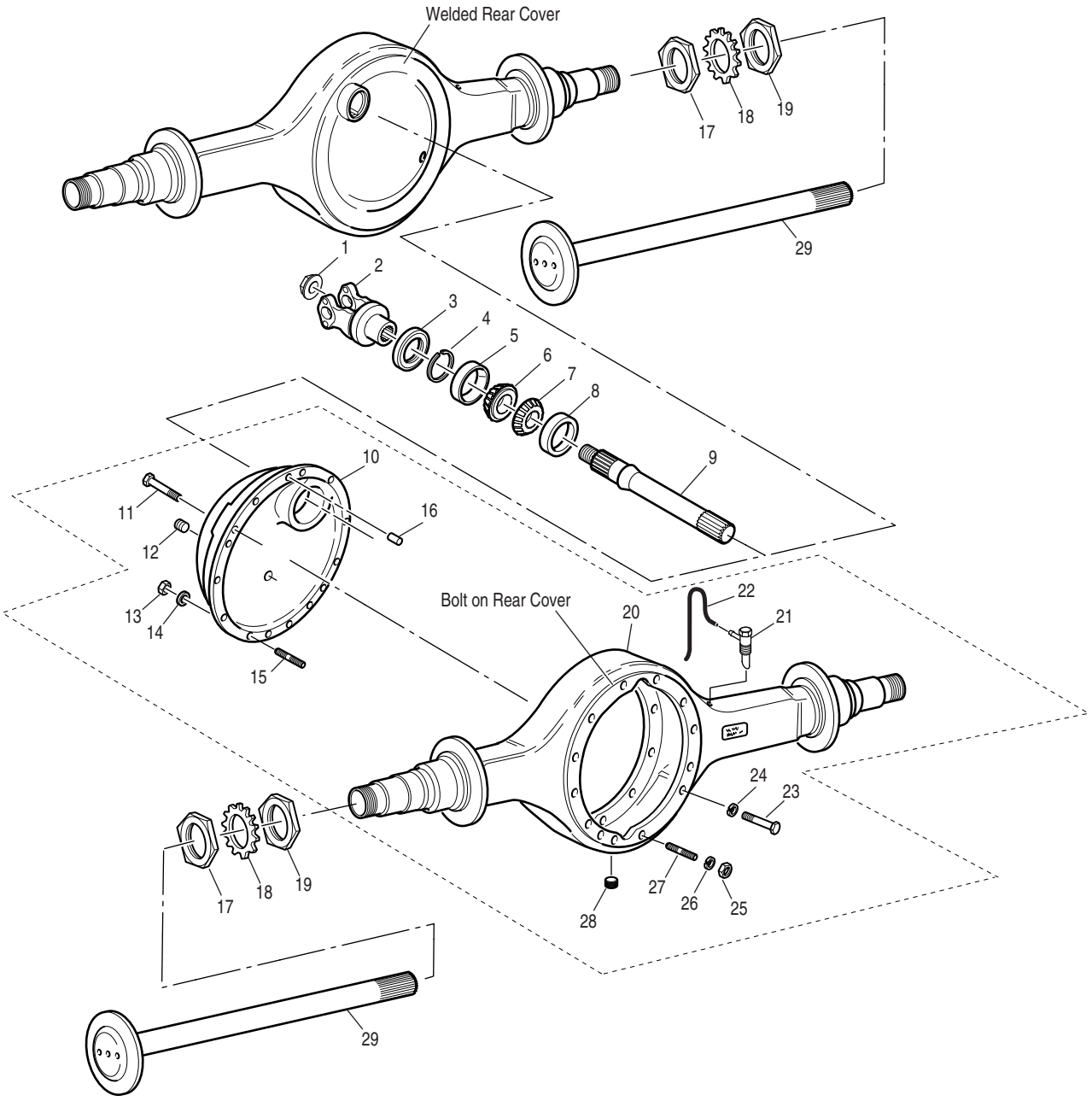
1— Sensor assembly
2— Fastener
3— Rotor assembly
4— Differential bearing adjuster
5— Sensor connector

Wheel Differential Lock Assembly - Parts Exploded View



1— Fixed curvic clutch gear
2— Snap ring
3— Curvic clutch gear
4— Spring pin
5— Shift fork
6— Compression spring
7— Push rod
8— Piston driver
9— Set screw
10— Piston
11— O-ring
12— Switch
13— Plastic washer
14— Piston cover
15— Capscrew-flange head
16— Capscrew-manual engagement
17— Gasket

Housing and Output Shaft Assembly - Parts Exploded View



1— Output shaft nut
2— Output yoke
3— Output seal
4— Snap ring
5— Outer bearing cup
6— Outer bearing cone
7— Inner bearing cone
8— Inner bearing cup
9— Output shaft
10— Rear cover
11— Rear cover capscrew
12— Fill plug
13— Rear cover nut
14— Lock washer
15— Stud
16— Dowel
17— Jam nut
18— Locking ring
19— Spindle nut
20— Axle housing
21— Breather
22— Breather hose
23— Carriage capscrew
24— Lock washer
25— Nut
26— Lock washer
27— Stud
28— Drain plug
29— Axle shaft

Fastener Torque Specifications

Power Divider	Class	Size	Tool	lbs. ft.	N•m
Diff. lock cover to carrier	8.8	M10 X 1.5	13 mm	28-35	38-47
Diff. lock switch	8.8	M12 X 1.5		10-12	14-16
IAD lock cover capscrew	8.8	M10 X 1.5	13 mm	28-35	38-47
IAD lock cover capscrews 2pcs.		M10 X 1.5	17 mm	28-35	38-47
Input brg. cage capscrew	10.9	M14 X 2	21 mm	114-140	155-190
Input shaft nut		M42 X 1.5	55 mm	840-1020	1140-1383
Power divider cover capscrew	10.9	M14 X 2	21 mm	114-140	155-190
Power divider pipe plug	NPTF	.750-14	1/2 Drive	40-60	51-81
Diff and Gearing	Class	Size	Tool	lbs. ft.	N•m
Front pinion helical nut	Grade 8	M42 X 1.5	65 mm	840-1020*	1140-1383*
Output shaft nut		M39 X 1.5	55 mm	680-832	920-1130
Rear pinion nut	8.8	M36 X 1.5	55 mm	575-703	780-953
Ring gear nut with bolt 126219**	12	M16 X 1.5	24 mm	215-255	292-346
Ring gear nut with bolt 129686**	11.9	M16 X 1.5	24 mm	260-280	352-380
Bolt 129686 (Torque Turn Angle)	Initial Torque	125 Nm (92 ft. lbs.)	Plus 65° Turn Angle		
Wheel diff. case capscrew	10.9	M14 X 2	16 mm 12 pt	114-140	155-190
Carrier	Class	Size	Tool	lbs. ft.	N•m
ABS sensor assembly fasteners		#1024 X 7/8	1/8 Allen	Finger tight +1 turn	
Carrier to housing capscrew	12.9	M16 X 2	24 mm	230-270	312-366
Carrier to housing nut	12	M16 X 1.5	24 mm	199-244	270-331
Diff. brg. capscrew	12.9	M20 X 2.5	30 mm	350-428	475-580
Filter assembly pump model	NPTF	.750-14	1 1/16	40-60	54-81
Lube pump attachment screw	8.8	M8 X 1.25	6 mm Allen	17-21	23-28
Thrust bolt jam nut	4	M24 X 2	36 mm	148-181	201-245
Housing	Class	Size	Tool	lbs. ft.	N•m
Axle cover capscrew	12.9	M12 X 1.75	18 mm	85-103	115-140
Axle shaft to wheel hub nuts		.500-20	11/16	55-71	75-96
		.625-18	15/16	170-190	230-258
		.750-16	1 1/8	285-345	386-468
Breather - old design	NPSF	.375-18	.750 Hex	20-26	27-35
Breather fitting - u-tube design		.375-18	.750 Hex	20-26	27-35
Housing cover nut	12	M12 X 1.25	18 mm	85-103	115-140
Magnetic plug (fill)***	NPSF	1 X 11.5	13/16	40-60	54-81

Power Divider	Class	Size	Tool	lbs. ft.	N•m
Oil drain plug	NPTF	.750-14	1/2 Drive	40-60	54-81
Temperature sender/plug				40-60	54-81

Note: Fasteners using self-locking thread “patches” may be reused if not damaged, but should be secured by a few drops of Loctite #277 on threaded surface. Reused fasteners should be wiped clean of excess oil, but do not require special cleaning

*** In June 1997, lube fill plug size was changed. See bulletin ABIB-9709.

** Ring gear bolt design changed 1/2/97. See bulletin ABIB-9701.

* Torque nut to 840 lbs. ft. (1140 N•m), then continue tightening to align nut slot with nearest hole in pinion shank.

Correct torque values are extremely important to assure long Spicer life and dependable performance. Under-tightening of parts is just as harmful as over-tightening.

Exact compliance with recommended torque values will assure the best results.

The data includes class and torque tightening values.

For spec'ing or service assistance, call 1-877-777-5360 or visit our website at www.dana.com

Dana Commercial Vehicle Products Group
3939 Technology Drive
Maumee, Ohio, USA 43537

www.dana.com

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All applications must be approved by the Application Engineering Department. Specifications and/or design are subject to change without notice or obligation.

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